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Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review

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TITLE

Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review

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KEY WORDS (max 6, current 5)

Added value, collaborating teams, multidisciplinary team meeting, regional oncology network, videoconferencing (MeSH term)

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ABSTRACT (max 300 words; 297 words)

Introduction

Various forms of video-conferenced collaborations exist in oncology care. In regional oncology networks, multidisciplinary teams (MDTs) are essential in coordinating care in their region. However, there was no recent overview of the benefits and drawbacks of video-conferenced collaborations in oncology care networks. In response, this scoping review presents an overview of videoconferencing (VC) in oncology care networks and summarises its benefits and drawbacks in terms of decision-making and care coordination.

Design

We searched four databases up to October 2020 for studies that included VC use in discussing treatment plans and coordinating care in oncology networks between teams at different sites. Two reviewers performed data extraction and thematic analyses.

Results

Fifty studies were included. Six types of collaboration between teams using VC in oncology care were distinguished ranging from multidisciplinary teams collaborating with similar teams, or with national or international experts, to interactions between palliative-care nurses and experts in that field. Claimed patient benefits were less travel for diagnosis, better coordination of care, better access to scarce facilities, and treatment in their own community. The benefits for healthcare professionals were optimised treatment plans through multidisciplinary discussion of complex cases, an ability to inform all healthcare professionals simultaneously, enhanced care coordination, less travel and continued medical education. However, VC added to the regular workload in preparing for discussions and increased administrative preparation.

Discussion

Benefits and drawbacks for collaborating teams were tied to general VC use. VC enabled better use of staff time and reduced the time spent travelling. VC equipment costs and the lack of reimbursement were implementation barriers.

Conclusion

VC is a highly useful communication platform for various types of collaboration in oncology networks and improves decision-making over treatment plans and care coordination, with substantial benefits for patients and specialists, but involves additional time and administrative preparation.

STRENGTHS AND LIMITATIONS of this scoping review (max 5, current 4)

- Scoping review that identified benefits and drawbacks of videoconferencing for collaborating teams in oncology networks (strength).
- In-depth analysis with detailed mapping of multidisciplinary teams collaborating in regional oncology networks showing the benefits and drawbacks (strength).
- Organisational, logistical and technical recommendations for collaborating teams who want to consider or optimise videoconferencing usage (strength).
- The results of some included studies were open to possible misinterpretation because the aims and qualitative descriptions were often not clearly explained (limitation).

INTRODUCTION

In oncology care, there are different types of collaboration between teams when coordinating integrated care for their patients¹¹⁻¹⁴. Some teams treating rare tumours search out the expertise of specialised national and international experts who then share their knowledge. Some teams in palliative oncology care consult specialists while caring for patients in the last phase of their life. Further, multidisciplinary teams (MDTs) in regional oncology networks are essential to provide a treatment plan and to coordinate care in their region. MDTs consist of specialists who focus on evidence-based treatment of patients. Oncology guidelines summarise the various key specialisms required for treating modalities surgery, medical oncology and radiotherapy, and for the different imaging specialisms depending on the biology of the tumour^{15, 16}.

In the 1990s, videoconferencing (VC) was introduced in oncology networks to address care pathways for high complexity - low volume care and for rare tumours. With VC, members of MDTs based in different locations but treating the same patient do not need to physically attend the multidisciplinary team meetings (MDTMs). Imaging, pathology and lab information could be shared during a VC session^{17, 18}. VC-MDTMs are often in addition to institution-based meetings, increasing workload and requiring coordination.

In an earlier scoping review of clinical applications of VC¹⁹, the characteristics of the studies included were summarised, but benefits and drawbacks were not evaluated. In a more recent review

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regarding e-health, VC was mentioned, along with its benefits and drawbacks, but not specifically for collaborating teams within oncology networks²⁰. An overview of the benefits and drawbacks would be helpful for policymakers and for teams collaborating across different locations in deciding whether to introduce VC to improve care coordination, lower costs and reduce travel time.

The current scoping review²¹⁻²³ was designed to provide an overview of different types of VC by teams collaborating in oncology networks. It then focussed on those MDTs that discuss diagnostic and treatment plans, and coordinate care within their regional oncology network. As such, our research questions were formulated as:

How does videoconferencing contribute to decision-making collaborating teams in oncology care at different locations?

What benefits and drawbacks of videoconferencing are perceived by MDTs in coordinating care in their regional oncology network?

METHOD

This review is reported according to the Preferred Reporting items for Systematic Reviews and Meta-Analysis for scoping reviews (PRISMA-Scoping-Review)²⁴. The objectives, inclusion criteria and methods adopted in this scoping review were specified in advance and documented in a protocol (Supplement 1).

Sources and search strategy

We searched four electronic databases: MEDLINE (PubMed), Embase (embase.com), CINAHL (EBSCO) and the Cochrane Library. The most recent search date was 27 October 2020.

The searches were developed in collaboration with an information specialist (SvdW). The search strategies were based on three concepts: 1) multidisciplinary, 2) videoconferencing and 3) oncology. For each concept, a controlled vocabulary (including MeSH terms) and free-text terms were combined (Supplement 2). No time or language restrictions were applied. In addition to the database searches, the references of included studies were also screened for additional relevant articles.

Screening and selection

Two reviewers (LvH and PD) independently assessed titles and abstracts. If a title and abstract provided insufficient information, or the reviewers disagreed, the full text was assessed by the same reviewers to determine inclusion. If the reviewers disagreed over a full-text assessment it was then discussed and, if no consensus was achievable, an independent reviewer (JR) provided a binding verdict.

Inclusion and exclusion criteria

To map different types of VC collaboration in oncology networks, we included studies if they were: 1) describing research on oncology care pathways, 2) original research, 3) full-text, 4) describing VC to communicate between teams at different locations, AND 5) reporting benefits and drawbacks of VC use. Studies were excluded if: 1) VC was only used for telemedicine^{25, 26}, indicating one of the groups at a location were patients only; 2) VC was solely used for research or education, OR 3) the article was a review, letter to an editor, or congress abstract.

Data extraction and analysis of subsets

Two assessors (LvH, PUD) extracted data in an iterative process. In Phase 1 of this scoping review, the following data were extracted for all the included studies: country of the teams using VC, aim of the study, research method and data source, number of cases discussed, number of VC and face-to-face MDTMs, benefits and drawbacks, frequency of VC-MDTMs, tumour type and study period. Based on these data, we performed a thematic analysis to distinguish different types of collaboration through VC. The similarities and differences were mapped by type.

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Since we were particularly interested in the types of collaboration adopted within regional oncology networks, we mapped the specific types of VC collaboration in detail regarding similarities and differences, and summarised the reported benefits and drawbacks, the members of the MDTs who discuss diagnostic and treatment plans, and specifics of the VC platform used. In assessing the collaborating MDTs, we mapped VC participants for the cancer treatment’s surgery, oncology and radiotherapy modalities, and described the VC Platform used.

If data were not sufficiently described in the paper reviewed, we looked in referred papers (describing the same study) or contacted the corresponding author via email, asking them to provide the missing information.

Patient and public involvement

This study was a scoping review on the use of VC by collaborating teams in oncology networks and therefore the study design did not seek patient and public involvement.

RESULTS

A total of 1422 unique records were identified (Figure 1). From this, 115 papers were selected for full text assessment, and one further paper was found in a reference list of an included study. After full text assessment, 50 studies remained for data extraction (Supplement 3).

[Insert here Figure 1: PRISMA-Scoping-Review: flow diagram selection of studies]

Study characteristics

VC was described in 37 studies related to oncology treatment for adults, 5 studies for children and adolescents and 8 studies on palliative care. VC was most frequently described for teams working in the USA (n = 12), the UK (n = 7) and Germany (n = 5) (Supplement 4). In 11 studies, multiple types of tumours were treated, 12 focussed on breast cancer, 11 on gastro-intestinal cancer, 8 on lung cancer, 6 on head & neck cancer and 17 on various other specific cancer types (Table 1). The frequency of multidisciplinary meetings ranged from daily to monthly.

Considerable heterogeneity was found between the studies concerning research methods, data sources, primary outcome, and details of reporting. In some studies, the aims, methods and data sources were not clearly described; we deduced the most likely aims, methods and data sources, which are shown in *italics* in the tables.

Table 1: Descriptives regarding VC use

For a detailed description of the six types of VC collaboration see Table 2. Added value evaluation of MDT-Equal and MDTM-Collaborate in terms benefits and drawbacks are shown in Table 3.

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat-ment type	Evaluation period
1. Expert MDTM-National								
Axford et al. (2002) ²⁷	United Kingdom (UK)	<i>Describe VC</i>	Review of audit form on cost, attendance and technical features	<u>Patient</u> : mean 4.8 cases in 42 VCs; B : less delay to start treatment; improved access to specialist (second) opinion; reduced travel costs. <u>HC</u> : mean 15 staff of which 8 participants in 42 VCs; B : less delay in diagnosis, because all members reviewed cases; less travel for staff (€ 2,400 ◀ per y); regular VC gave less need for correspondence between centre and remote partner; D : first year 1 VC aborted due to internet problems.	W	Breast, lung, colorectal, esophageal, gastric	At	Nov 2000 to Oct 2001
Billingsley et al. (2002) ²⁸	USA	Describe VC	Review of case records	<u>Patient</u> : 85 cases; 38% referred to cancer centre; B : less travel for diagnosing; <u>HC</u> : B : more patients referred that need complex surgery or multimodality cancer treatment e.g. ChemoRT; implementation of peer review programs for ChemoRT and RT; treatment planning in region improved; D : success depended on dedication of coordinators on collaborating sites; image quality too low for anatomic details to be shown.	Bw	Head-and-neck, lung, colon, leukaemia, other	At, Pc	2000-2001
Bumm et al. (2002) ²⁹	Germany	Describe VC	<i>Review of databases</i>	<u>Patient</u> : 3298 cases (2438 patients). <u>HC</u> : 1 case in 5 min.; duration VC 30-35 min.; B : improved contact with HC from remote places with only computer available; easier obtained second opinions; improved interdisciplinary communication; local therapy was reviewed and incorporated in process flow of centre; improved team education; D : -.	D	Esophagus, stomach, pancreas, colon, liver, rectum	At	Oct 1999 to Feb 2002
Delling et al. (2002) ³⁰	Germany	Describe VC	<i>Review of databases</i>	<u>Patient</u> : 121 cases; 27 cases had frozen section pathology of which in 24 the concept diagnosis was correct. <u>HC</u> : B : although on a large distance, there was a close interdisciplinary cooperation; review of pathohistological diagnoses gave training on the job for young, less experienced orthopaedists and pathologists which improved safety in diagnostics and optimized therapy; D : discussions on usefulness of VC vs costs.	W	Bone	At	Aug 2001 to May 2002*

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat- ment type	Evaluation period
Niemeyer et al. (2003) ³¹	Germany	<i>Describe VC</i>	<i>Review of databases</i>	Patient: 190 cases; 51 cases had frozen section pathology: 39 diagnostic and 12 during surgery, in which 11 showed tumour free surfaces. HC: duration VC 45 min.; B: close interdisciplinary cooperation over a large distance; optimal location and strategy for biopsy were discussed according to guidelines of the international bone tumour centres; review of pathohistological diagnoses gave training on the job for young, less experienced orthopaedists and pathologists; D: -.	W	Bone	At	Aug 2001 to Feb 2003*
Bauman et al. (2005) ³²	Canada	Feasibility of VC for regional participation	Survey among participants	Patient: mean 5 cases in 6 VCs. HC: 1 case in 20 min.; B: in 60% of cases recommendations for change were made; clinical research associates attended VC to recruit for clinical trials (40% eligible); D: barrier to MDTM (VC or FTF) participation was scheduling conflicts. SV: 17 of 21 SVs returned.	M	Prostate, bladder, renal, testicular	At	Jan 2003 to June 2003
Norum et al. (2006) ³³	Norway	Feasibility of VC and e- mail	<i>Review of case records</i>	Patient: 5 cases; B: improved access to cancer specialists. HC: 78% educational VC, costs were lower at >12 VCs per y; B: improved collaboration between centre and remote partners; certification of palliative care unit for training medical oncologists; due to frequent VC, use of e-mail service went down; D: 84% of 32 planned VCs succeeded (problems occurred in the first months).	W	Breast, colorectal	Pc	Nov 2002 to Nov 2003
Dickson- Witmer et al. (2008) ³⁴	USA	<i>Describe VC</i>	<i>Review of case records</i>	Patient: B: waiting time between diagnosis and treatment decreased, PET-scan 14-21 d to 7d, CT 7 d to 1 d; increased stage III Colon cases referred for ChemoRT from 47% (2004) to 95% (2006). HC: 6-8 cases discussed with 40 HCs in 1 h; B: educational value in discussing complex cases; compliance to treatment standards went up from 92% (2004) to 95% (2006) for recommendations given; improved access to services that other hospitals lack, e.g. genetic counselling; clinical trial accrual increased at least 2%; D: working out bugs between different systems was time consuming.	W	CNS, breast, chest, gynaecological, genitourinary, lymphoma	At	2006

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treatment type	Evaluation period
Salami et al. (2015) ³⁵	USA	Evaluate VC	Review of databases	Patient: 116 cases, of which 41% in VC; in VC more were ≥ 65 years (29%), had higher degree of comorbidity (79%) and had portal hypertension (49%) compared to cases in FTF (15%, 44%, and 28%); B: less travel. HC: B: decreased waiting time to diagnosis VC (median 26 d) vs FTF (median 63 d); less travel distance VC compared to FTF; in VC increased multidisciplinary (92%) and guideline driven evaluations (100%) vs FTF (65% and 75%); D: -.	W	HPB	At	2009 to 2013
Thillai et al. (2016) ³⁶	UK	Evaluate VC for early referral	Review of databases	Patient: 159 cases; 42% referred at initial diagnosis. HC: B: increased awareness among specialists that decision to operate or not should be made in a HPB MDTM to ensure that operable cases are not missed; D: in 22 of 53 not referred cases, imaging was not available for evaluation.	2W	Colorectal with liver metastases	At	2012, 6 months
Wilson et al. (2016) ³⁷	Australia	Feasibility VC	Review of case records	Patient: mean 8.7 cases in 18 VCs (2010) vs mean 8.0 cases in 25 VCs (2011). HC: 28% increase in cases in 2011 due to improved administrative support; B: decreased waiting time to case discussion in MDTM from referral (standard 14 d) mean 28% to 42%; clinical trial accrual increased from 0% to 11%; D: more delay with biweekly VC (recommended weekly).	Bw	Upper GI	At, Pc	Jan 2010 to Dec 2011
Powell et al. (2018) ³⁸	USA	Feasibility VC for molecular profiling	Prospective cohort Molecular Profiles Tumour response and patient survival	Patient: 109 of 120 cases profiled; 16% of patients declined recommended treatment and preferred palliative care in a hospice, because they were too ill; tumour response and survival (n=16) in genome clinical trials were similar to that (n=16) receiving Food and Drug Administration off-label treatment. HC: B: 58% of patients heard recommendations on their treatment plan from their treating physician in the community setting; continuous education; D: -.	2W	Advanced solid tumours	At	June 2014 to Dec 2015

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat- ment type	Evaluation period
Rosell et al. (2019) ³⁹	Sweden	Evaluate VC	Survey among participants Observation of behaviour	<u>Patient</u> : -. <u>HC</u> : B : national VCs support further education and stimulate knowledge sharing; D : low attention to patient related aspects; low involvement of local HC. <u>SV</u> : 125 of 241 SVs returned of which 87% MDs (56% surgery, 26% medical oncology, paediatric oncology 10%, radiology 6% and pathology 2%), 11% nurse, medical secretaries 2%.	W	Esophageal, HPB, anal, vulvar, penile, childhood cancer	At, Pt	May 2017 to May 2018
Brandl et al. 2020 ⁴⁰	UK – Ireland	Evaluate VC	Data base review Follow-up for survival information	<u>Patient</u> : mean 4.6 new cases in 34 VCs; 35 patients were discussed more than once; 19 of 22 had complete cytoreduction of cancer cells after surgery. <u>HC</u> : B : effective selection for specialised, expensive treatment (87% diagnosis confirmed); D : -.	M	Peritoneal mesothelioma (GI)	At	Mar 2016 to Dec 2018
Fitzgerald et al. (2020) ⁴¹	Australia - New Zealand	Feasibility VC for review of stereotactic chart use	Review of case records	<u>Patient</u> : 285 cases of which 237 were new. <u>HC</u> : 1126 attendances in 12 months from 114 participants of 21 locations including 27 radiotherapists from 13 locations; mean 1.2 recommendations per patient; B : improved national guideline compliance; mentorship and guidance for multidisciplinary team; inverse relationship between VC case load and recommendations (p < 0.002); D : with increasing workload, manual reviews of every case across the network was not feasible.	W	CNS, lung, liver, bone, spine	At	July 2018 to July 2019
Pan et al. (2020) ⁴²	USA	Feasibility VC	Review of case records Survey among referring physicians	<u>Patient</u> : 1585 cases: 60 in 2013 increased to 364 in 2019. <u>HC</u> : B : improved quality of care over the years (2013, 2016, 2019), e.g. management of cases; improved confidence of treating community physicians; recommendations were more often implemented in 2019 vs 2015; D : in early phase: lack of nurse coordinator, schedule conflicts, inconsistent participation by some specialists (50% pathology, upon extra hire it increased to 95%). <u>SV</u> : 6 months (2013): 6 SVs returned; 3 y (2015): 32 SVs returned; 6 y (2019): 54 SVs returned.	M - Bw - W	Sarcoma	At	2013 to 2019

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treatment type	Evaluation period
Rosell et al. (2020) ⁴³	Sweden	Evaluate VC	Survey among participants	<u>Patient</u> : -. <u>HC</u> : B : provide support in decision-making, strengthen collaborations and professional networks, and develop individual and team-related competence; D : suboptimal attendance: time and resource constraints, unclear patient assignment mandate and low adherence to referral guidelines. <u>SV</u> : 125 of 241 SVs returned of which 87% MDs (53% surgery, 26% medical oncology, radiology 6%, pathology 2% and 'none of the name' 14%), 11% nurse.	W	Esophageal, HPB, anal, vulvar, penile, childhood cancer	At, Pt	May 2017 to May 2018
2. Expert MDTM-International								
Bharadwaj et al. (2007) ⁹	USA – India	Evaluate VC	<i>Review of case records</i>	<u>Patient</u> : 26 cases; 50% had severe pain; 10% was hospitalized; mean care 40 d; B : less symptoms; improved QoL for patients and caregivers. <u>HC</u> : duration VC 60 – 90 min.; 81 e-mails for follow-up, treatment strategies, doubts and clarifications; 4 text messages for urgent consultation; B : 11 cases presented in 'Subjective-Objective-Assessment-Plan'-format; didactic information on symptom management in the 'Education on Palliative and End-of-Life Care' curriculum; increased confidence MDs in India; D : minor technical difficulties (relay of voice); US participates after usual business hours, due to 12 h time difference.	3W	77% cancer, <i>not specified</i>	Pc	2006***, 2 months
Qaddoumi et al. (2007) ⁵	Jordan – Canada	Feasibility of VC	<i>Review of case records</i>	<u>Patient</u> : mean 3.6 cases in 20 VC; in 23 cases recommendations on treatment plans were significant changes, which were followed in 21; increased survival. <u>HC</u> : max. 6 cases per VC; B : recommendations were seen as formal second opinions; continuous medical education that emphasized team and multidisciplinary approach; to encourage participation, VC was granted 1 h institutional study credits; used to introduce new concepts; comprehensive reviews provided excellent quality assurance; D : optimal duration of collaboration is unclear.	M	CNS	Pt	Dec 2004 to Apr 2006

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat- ment type	Evaluation period
Qaddoumi et al. (2008) ⁶	Jordan – Canada	Evaluate VC	<i>Review of case records</i>	<u>Patient</u> : mean 3.9 cases in 26 VC; B : gradual decreased delay between surgery and radiation; increased survival. <u>HC</u> : B : review of radiation fields decreased necrosis due to field overlap; interactive discussions between teams members on treatment approach; more cases eligible for clinical trials; D : hierarchical health care systems may see the introduction of new techniques by young, Western trained MDs as a potential threat.	M	CNS	Pt	Dec 2002 to Dec 2006
Amayiri et al. (2018) ⁴⁴	Jordan – Canada	Evaluate VC sustainability	Review meeting minutes	<u>Patient</u> : mean 3.6 cases in 20 VCs, 2004-2006; mean 4.9 cases in 33 VCs, 2007-2009; mean 3.8 cases in 32 VCs, 2011-2014; 16 suggestions for molecular testing, 2011- 2014 were followed in 6 cases; B : increased trust of parents in local treating team, with increased decisions not to seek treatment abroad. <u>HC</u> : B : less recommendations given, in 44% to 30% to 24% of cases; more education and feedback over the years by sharing meeting minutes with some full-text articles; costs VC went down (280 to 30 Euro ▲/ h); D : turnover of MDs contributed to the need for continuous support.	M	CNS	Pt	Dec 2004 to Apr 2006 vs Jan 2007 to Dec 2009 vs Aug 2011 to Apr 2014
Mayadevi et al. (2018) ⁴⁵	India – USA	Feasibility of VC for dysphagia	Review of case records	<u>Patient</u> : mean 1.4 cases in 18 VCs. <u>HC</u> : B : recommendations improved oral intake; easy and cost-effective access to external expertise; improved interdepartmental collaboration; improved education and training in specialized clinical problems like dysphagia management; D : -.	M	Head-and-neck	At	18 months

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treatment type	Evaluation period
3. Expert Consultation								
Sezeur et al. (2001) ⁴⁶	France	Evaluate VC for transfer of patients	Review of case records Survey among patients	<u>Patient</u> : mean 3.2 cases in 27 VCs; 48 case discussions and 39 second opinions; in 2 of 48 cases treatment plans were changed; patients remembered 80.5% of information given after 24 h; B : preferred VC with oncologist and surgeon, because they made a shared decision on where chemo would take place. <u>HC</u> : B : complementary teams working together had a better link and facilitate multidisciplinary; saved € 77.85 per patient on transport by ambulance; D : increased workload for surgeons presenting cases to oncologists; expertise provoked in certain colleagues of general hospitals some distrust that hindered development of a cancer network; low speed of connection gave less diagnostic image quality. <u>SV</u> : 16 of 16 SVs returned on VC; 12 of 16 SVs returned on memorization.	2W	Gastric	At	Nov 1996 to Mar 1998**
Stalfors et al. (2005) ⁴⁷	Sweden	Evaluate cost of FTF vs VC	Health economic analysis Survey among patients	<u>Patient</u> : 50 cases FTF, 68 cases VC. <u>HC</u> : B : cost VC (€ 236) less than FTF (€ 263); MDs accompanied patients in 100% of VC-sessions vs 15% of FTF (if 100% attendance MD in FTF € 623); D : cost less if VC equipment is used more often. <u>SV</u> : 39 of 50 FTF vs 45 of 68 VC patient SVs returned.	W	Head-and-neck	At	Sept 1998 to Sept 1999
Chekerov et al. (2008) ⁴⁸	Germany	Feasibility of VC	Review of case records Survey among participants	<u>Patient</u> : mean 4 cases (range 2-7) in 39 VCs; 144 cases and 121 second opinions. <u>HC</u> : mean 17 participants in 39 VCs, who attended median 6 VCs; 98% recommendations were accepted; B : time saving; support difficult diagnostic and treatment decisions; cost reduction second opinions (no patient travel); extensive scientific exchange; improved advanced education; D : -. <u>SV</u> : 43 of 75 SVs returned first; 51 of 75 SVs returned.	Bw	Gynaecological	At	Dec 2004 to Aug 2006

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat- ment type	Evaluation period
Schroeder et al. (2011) ⁴⁹	Germany	Evaluate VC	Survey among participants	<u>Patient</u> : mean 3.5 cases (range 1-7) in 131 VCs; 398 second opinions; B : no hospital visit for second opinions; in format VC-case discussion patient preferences were presented. <u>HC</u> : median 14 participants in 131 VCs; B : 50% VC-participants asked more second opinions; gain of knowledge – understanding of recommended therapy; redundancies in therapeutic management avoided; improved cooperation with colleagues from other care sectors; D : -. <u>SV</u> : 205 of 275 SVs returned.	Bw	Breast, gynae- cological	At	Dec 2004 to June 2009
Seeber et al. (2013) ⁵⁰	Italy – Austria	Feasibility of VC	<i>Review of case records (historical vs VC)</i>	<u>Patient</u> : 93 historical, 110 VC; mean 1 case in 104 VCs. <u>HC</u> : 8 minor and 20 major treatment plan changes (25%); B : improved access to cancer-centre-specific treatment modalities like RT (63 RT treatments in VC vs 34 historical); D : -.	Bw	Lung	At	May 2003 to Aug 2007 Aug 2007 to May 2011
Stevenson et al. (2013) ⁷	USA	<i>Describe VC</i>	Review of case records Survey among participants	<u>Patient</u> : mean 1.7 cases in 10 VCs (2011), 22 cases in 13 VCs (2012). <u>HC</u> : mean 10 participants per VC; 1 case in 30 min.; clinical leader or champions per department improved participation (at first only medical and radiation oncology attended); B : improved care due to review of radiology and histologic images staging the disease before treatment plan decision was made; improved communication and referral times between sub-specialisms; reduction overall costs of MDTM by VC in rural community; D : minimal disruption of software resulted in disconnection of individual participant; conflict in meeting schedules. <u>SV</u> : 10 of 20 SVs returned.	Bw	Lung	At	2009-2013
Crispen et al. (2014) ⁵¹	Bahamas, Trinidad and Tobago	Evaluate VC for peer review in radiotherapy	Review of case records Survey among participants	<u>Patient</u> : 40 cases, 10 from each tumour type. <u>HC</u> : Radiotherapists were satisfied with audio-visual aspects of VC; B : peer-review programme allowed radiotherapists to collaborate from different locations; D : RT standard has no security or confidentiality guide. <u>SV</u> : 10 of 10 SVs returned.	W	Head-and- neck, breast, cervical, prostate	At	July to Nov 2013

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treatment type	Evaluation period
Shea et al. (2014) ⁵²	USA	Feasibility of VC	Survey among participants Interviews among participating specialists Observations of VC	<u>Patient</u> : 15 cases from 6 counties; <u>HC</u> : 14 VCs observed; B : easy to get second opinion on complex cases; D : more time needed to prepare a case by centre; increased time lag for community-based clinicians, due to 3 d requirement to send information for VC; problem to receive presentation in advance; scheduling conflicts in the timing of VC for community-based clinicians, because VC is integrated into the centres FTF MDTM; lack of reimbursement for VC. <u>SV</u> : 32 of 32 SVs returned. <u>Interv.</u> : 28, 16 centre vs 12 community-based.	Bw	All	At	Aug 2011 to March 2012
Frappaz et al. (2016) ²	France	Describe VC national expert consultation	<i>Review of case records</i>	<u>Patient</u> : mean 3.7 cases in 46 VCs; 48% primary tumours. <u>HC</u> : B : improved understanding of biology of brain tumours due to discussions on complex cases; optimized therapy by multidisciplinary consultations; D : -.	W	CNS	Pt	2015
Burkard et al. (2017) ⁵³	USA	Evaluate VC Precision Medicine Molecular Tumour Board	Review of databases	<u>Patient</u> : mean 3.2 case in 23 VCs; 48 cases in registry of which 38 had recommendations and clinical follow-up. <u>HC</u> : max. 6 cases in 1 h; mean time referral to presentation 13.5 d; B : no-cost clinical service accessible to oncologists in the region; improved access to clinical trials which aim to find new biomarkers (18 genes); implementation of precision oncology knowledge; continuing medical education in molecular pathology; D : 1 of 14 patients enrolled in clinical trials in the state due to advanced illness, no outside-state trial enrolment.	Bw	Breast, gastric, lung	At	Sept 2015 to Sept 2016
Abu Arja et al. (2018) ⁴	USA, Latin American countries	Evaluate Latin American VC	Survey among participants	<u>Patient</u> : -. <u>HC</u> : 1 h sufficient to discuss requested cases from 20 countries; B : 39% attendees said sending pathology slides to USA was easy and helpful; continuing medical education opportunity; D : costs of sending slides to USA; attendance barriers: workload, timing VC (time of day, day of week), internet problems. <u>SV</u> : 95 of 159 SVs returned (66 frequent attendance, 23 not-frequent, 11 never attended).	W	CNS	Pt	Dec 2017 to Mar 2018***

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat- ment type	Evaluation period
4. Consultation Specialist - Nurse								
Saysell et al. (2003) ⁵⁴	UK	Evaluate VC	Survey among participants Focus groups	<u>Patient</u> : mean 0.9 cases in 29 VCs; 96% cancer; B : stayed longer in the community; improved condition. <u>HC</u> : mean 5 attendees in 29 VCs; 12 additional monthly educational VCs; 19 symptom control issues discussed; B : effective in getting medical expertise; educational value in reflecting on own practice; improved standards of care; better use of available time; planning treatment ahead; taking part as a group helped to develop as a team; D : 1 case failure ISDN connection, rest of session by telephone; increased workload preparing VC; pressure to contribute a case or issue; time lapse between problems arising and being discussed in VC. <u>SV</u> : 25 of 26 SVs returned.	W	Breast, lung, bladder, prostate, gastric, ovarian	Pc	Oct 2001 to Oct 2005
O'Mahony et al. (2009) ⁵⁵	USA	Evaluate VC for Bioethics and QoL	Pre- and post- education test for staff Survey among patients and staff with Palliative Care Outcome Scale (POS)	<u>Patient</u> : B : less deliria; improved QoL; D : feared that they would have less consultations when evaluating clinicians; not suitable for immobile patients. <u>HC</u> : mean 5.5 staff with 1 family member in 13 VCs vs mean 5.8 staff with 0.9 family member in 14 FTFs; B : increased medical knowledge due to education; improved pain management; D : higher suspicion towards research in staff; up-to 90 min. preparations time in an off-unit conference room; 1 VC rescheduled due to internet problems. <u>SV</u> : 75 POS SVs returned: 33 staff, 23 family caregivers, 19 patients.	2M	<i>Not specified</i>	Pc	Mar 2008 to Jan 2009
Donnem et al. (2012) ⁵⁶	Norway	Feasibility of VC	Review of case records Survey among participants	<u>Patient</u> : mean 1.6 cases in 106 VCs; 75% palliative; B : 82% stayed in community for symptom management (pain management and nutrition) after VC introduction vs 70% before VC. <u>HC</u> : median 7 participants in 106 VCs; B : reduced waiting time for consultation with oncologist at centre with 8 d to max. 7 d; improved care (85%); secured networking with centre; educational programs for communities and general hospitals; confidence of local providers improved (97%); D : -. <u>SV</u> : 141 of 167 SVs returned.	W	Breast, colorectal	At, Pc	Mar 2009 to Sept 2010

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treatment type	Evaluation period
Watanabe et al. (2012) ⁵⁷	Canada	Feasibility of VC for palliative RT consultation	Prospective case series Survey among participants and patients	<u>Patient</u> : 44 new cases from 29 communities with 28 follow-up visits; <u>B</u> : 7.96 h saved time, € 149.93▲ saved expense per visit; patients had less anxiety scores and improved appetite at first follow-up ($p < 0.01$ and $p = 0.03$); <u>D</u> : travel to community centre for VC; occasional delay because GP was not available. <u>HC</u> : 1 new case in 90 min. and 1 follow-up visit in 30 min. in 1 VC; <u>B</u> : increased awareness of symptom management issues; more future referrals; <u>D</u> : increased workload for oncologists at centre and for GPs; 1 visit completed by telephone due to technical difficulties. <u>SV</u> : 19 of 44 GP SVs returned; 44 of 44 patient SVs returned.	W	All	Pc	Jan 2008 tot Mar 2011
5. MDT-Equal								
Delaney et al. (2004) ¹	Australia	Evaluate FTF vs VC	Anthropological analysis of interpersonal interactions Pre- and post-survey among participants	<u>Patient</u> : median 4 cases per VC vs 6 FTF; <u>HC</u> : median 10 participants VC vs 8 FTF; more formal behaviour (less joking). <u>SV</u> : pre 16 of 27 vs post 16 of 26 SVs returned.	W	Breast	At	Feb to July 2000
Savage et al. (2007) ⁸	UK	Evaluate VC	<i>Review of case records</i> Survey among participants	<u>Patient</u> : 48 new cases with 182 issues; 29 complex cases. <u>HC</u> : timing and frequency of VCs was appropriate (92% and 96%). <u>SV</u> : 50 of 85 SVs returned.	M	Head-and-neck	At	Nov 2003 to June 2006
Marshall et al. (2014) ⁵⁸	United States of America (USA)	Feasibility of VC	Review of case records Survey among participants	<u>Patient</u> : access to cancer centre stayed 7.5 d. <u>HC</u> : partner brought 14 of 90 cases by VC; 1 case in 13.1 min. VC vs 8.4 min. FTF ($p = .004$); 12 of 16 MDTMs used VC during part FTF MDTM. <u>SV</u> : 36 of 36 SVs returned.	W	Breast, esophageal, gastric, HPB, colorectal, melanoma, sarcoma	At	4 months
Alexandersson et al. (2018) ⁵⁹	Sweden	Evaluate VC costs	Observation of VC Survey among participants	<u>Patient</u> : mean 12.7 cases per VC and FTF-session. <u>HC</u> : mean duration VC 68 min. vs FTF 46 min.; 14 of 50 MDTMs used VC during part of FTF MDTM. <u>SV</u> : 104 of 105 SVs returned.	W	All but hematologic cancers	At	Feb to July 2016

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treat-ment type	Evaluation period
Van Huizen et al. (2019) ⁶⁰	Netherlands	Evaluate VC	Review of case records Observation of VC Interviews among participants	<u>Patient</u> : mean 18.6 cases per VC; 336 cases in 18 VCs got 8 recommendations (2%), that were major or minor changes aimed at optimization of treatment outcome. <u>HC</u> : complex cases were discussed more than once; during 61% of VCs all key specialists were present. <u>Interv.</u> : 6 specialists, 3 at each site.	W	Head-and-neck	At	Sept 2016 to Feb 2017
6. MDTM-Collaborate								
Hunter et al. (1999) ⁶¹	USA, Pacific	Describe web-based VC	Survey among participants Assessment of technical features	<u>Patient</u> : 103 cases; 16 evacuations to cancer centre prevented. <u>HC</u> : >84% cases discussed were major contribution to VC session; audio and image quality: 79% and 100% >good; pathology and radiology imaging: 89% and 75% >good; costs centre vs remote partner € 304▼ vs € 511. <u>SV</u> : 38 of 38 SVs returned.	W	All	At	Oct 1996 to Dec 1998
	USA, North Carolina	Describe ISDN VC	Survey among participants Assessment of technical features	<u>Patient</u> : 304 cases. <u>HC</u> : >95% case discussions were major contribution to VC session; audio and image quality: 100% good, pathology and radiology imaging: 95 and 95% >good; costs centre vs remote partners € 250▼ vs € 335. <u>SV</u> : 22 of 25 SVs returned.	W	Breast	At	Feb 1998 to Jan 1999
Olver et al. (2000) ¹⁰	Australia	Evaluate VC	<i>Review of case records</i> Survey among participants and patients	<u>Patient</u> : median 30 cases per y. <u>HC</u> : 10 of 17 MDs using VC changed their way of working practice. <u>SV</u> : 20 of 20 participant SVs returned (including 3 nurses); 8 patient SVs returned.	W	Breast	At, Pc	1999***, 3 months
Davison et al. (2004) ⁶²	UK	<i>Describe VC</i>	<i>Review of case records</i>	<u>Patients</u> : 62% (15) cancer cases in 28 VCs; reduced length of stay with 0.67 d. <u>HC</u> : range 1-7 cases in 1 VC; surgery access time reduced from 69 ± 38 to 54 ± 26 d; achieved standard treatment within 56 d; increased resection rate from 14.7 to 19.0 per y.	W	Lung	At	Nov 2000 to Oct 2001

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding VC use	Freq.	Tumour type	Treatment type	Evaluation period
Kunkler et al. (2006) ⁶³	UK	Evaluate FTF vs VC	Survey among participants before and in week 28 of the RCT	<u>Patient</u> : -. <u>HC</u> : GBI showed positive scores for both FTF and VC, e.g. on decision making and efficiency; minor difference for FTF e.g. less physical resources. <u>SV</u> : 33 of 44 FTF returned (pre VC); 24 of 32 VC (post VC); 11 pre- / post VC returned of same participant.	W	Breast	At	Mar 2004 to Apr 2005
Kunkler et al. (2007) ⁶⁴	UK	Evaluate FTF vs VC	Participant satisfaction on case discussions Economic evaluation	<u>Patient</u> : median 7 cases in FTF vs 5 in VC; 195 cases in FTF vs 278 VC; <u>HC</u> : 28 FTF- and 48 VC-sessions; same confidence level treatment plan decisions; costs were lower at >40 VCs per y.	W	Breast	At	Mar 2004 to Apr 2005
Stevens et al. (2012) ⁶⁵	New Zealand	Evaluate FTF vs VC	Review of meeting minutes	<u>Patient</u> : 35% RT-cases VC vs 29% RT-cases FTF. <u>HC</u> : no sign. differences FTF vs VC in waiting time from diagnosis to start RT and on % recommended RT vs treatment performed.	W	Lung	At	Jan to June 2009
Murad et al. (2014) ⁶⁶	Pakistan	Evaluate VC	<i>Review of case records</i>	<u>Patient</u> : mean 3.7 cases, mean 13 min. per case; drop-outs for chemotherapy after surgery reduced from 36% to 19%. <u>HC</u> : 31% minor changes, 12% major changes; departmental database was started for management evaluation purposes.	W	Breast, gastric, endocrine, skin, soft tissue	At	Nov 2009 to Dec 2011
Novoa et al. (2016) ³	Spain	Evaluate occasional vs regular weekly VC	<i>Review of databases</i>	<u>Patient</u> : 563 cases occasional vs 464 cases weekly VC. <u>HC</u> : ratio 0.70 thoracic surgery cases / new cases seen in occasional VC went up to 0.87 in weekly VC.	W	Lung	At	2008-2010 vs 2011-2013

Legend

Abbreviations: CNS = Central Nervous System; d = days; chemo = chemotherapy; ChemoRT = Chemoradiotherapy; FTF = face-to-face, physically; GBI = Group Behaviour Inventory; GI = Gastro-Intestinal; GP = General Practitioner; HPB = Hepatobiliary; h = hour; ISDN = Internet Service Digital Network; MD = Medical Doctor; MDTM = Multidisciplinary Team Meeting; min. = minutes; POS = Palliative Care Outcome Scale; QoL = Quality of Life; RCT = Randomized Controlled Trial; RT = Radiotherapy; VC = Videoconferenced-MDTM. HC: healthcare professionals; SV: survey; Interv.: interview; **B**: = Benefit; **D**: = Drawback; benefits and drawbacks for MDT-Equal and MDTM-Collaborate are shown in Table 3.

We recorded VC for diverse wording in the studies: tumour board by VC or multidisciplinary team by VC or collaborative care team by VC or International Tumour Board by VC; Multidisciplinary Cancer Conferences by VC.

We used the term cases when a patient’s case was presented or discussed in a VC or FTF meeting; one patient might be discussed multiple times in successive MDTMs.

Explanation of coding of frequency: Freq. = frequency of MDTM; W = Weekly, 2W or 3W = twice or trice per week, M = Monthly, 2M is twice per month, D = Daily, Bw = Bi-weekly.

Explanation of coding of treatment: At = Adult treatment, Pc = Palliative care, Pt = Paediatric treatment.

Additional information: * study period from main text, ** referred paper with details on study, *** corresponding author; ▼ = exchange rate 1999: for 1 USD you get 0.94 Euro; ▲ = exchange rate 2012: for 1 USD you get 0.78 Euro; ◀ = exchange rate 2002: for 1 British Pound you get 1.6 Euro; ▶ exchange rate 1999: for 1 SEK you get 0.116 Euro.

If authors had not clearly stated the aim of the study, the research method or the data sources, the text in *italics* is the interpretation of the authors of this review.

For the description of the aim of the study we used the word ‘describe’ if the paper described, reported or showed the result; we used the word ‘evaluate’ if the study evaluated, analysed or assessed outcomes. We used ‘review of case records’ if the paper did not clearly state research method and the data source. If we could not retrieve the information in the results, we recorded ‘Not reported’.

The most frequently used research method in the reported studies was review of databases, case records or VC notes (31 studies). A survey among healthcare professionals, or patients and their families, on the use of VC was also a frequently applied method (23 studies). In 23 studies, two or more data sources were combined.

Thematic analysis and synthesis of subsets

Six types of team collaboration in oncology care were distinguished (Table 2).

1) Expert MDTM-National: providing expertise and experience on rare tumours nationally (17 studies), 2) Expert MDTM-International: providing international expertise and experience on rare tumours (5 studies), 3) Expert Consultation: physicians caring for complex patients seeking a consultation with experts (11 studies), 4) Consultation Specialist – Nurse: nurses consulting with palliative treatment specialists in specialised palliative care units or hospices (4 studies), 5) MDT-Equal: involving more-or-less equal MDTs that use each other for a ‘fresh look’ to optimise the diagnostic and treatment plans for complex cases (5 studies) and 6) MDTM-Collaborate: MDTs collaborating to form one MDTM (8 studies).

We used the term ‘MDT-Equal’ for teams that had broadly equal expertise and know-how in treating a specific type of patient. Here, the opting to use VC was to optimise treatment plans and to coordinate care. To be classified as such a team, at least two key specialisms for diagnosing and treatment and at least two 2 specialists needed to be present at each site. In comparison, the term ‘MDTM-Collaborate’ is used for teams that have complementary expertise and need each other to make a complete team of experts to treat and to coordinate care for a specific type of patient. Together the individual teams form an MDTM and, through this, comply with national legislation and oncology guidelines.

Table 2: Features of the types of VC collaboration identified in oncology networks

Feature vs type	Expert MDTM-National	Expert MDTM-International	Expert Consultation	Consultation Specialist – Nurse	MDT-Equal*	MDTM-Collaborate**
Healthcare professionals in VC meeting	Same type of specialists in national expert team discuss with MDTs at different locations via VC	Specialists of an MDT in one country give advice to and discuss with MDTs in a low-income country via VC	Specialists with expertise give advice via VC to treating physicians	Consultant for palliative care gives advice via VC to nurses in palliative care unit or hospice on care plan	Same type of specialists in MDTs at different locations discuss via VC	Complementary specialists at different locations together form a single MDTM via VC
# healthcare professionals	≥2 each site	≥2 each site	1 or more	1 or more	≥2 each site	≥2 each site
Purpose	Provide expert opinion and advice on diagnostic or treatment plan	Provide expert opinion and advice on diagnostic or treatment plan	Provide expert opinion and advice on treatment plans	Provide medical specialist advice on care plans and incident handling	Optimize diagnostic or treatment plan made in onsite MDTM	Formulate diagnostic or treatment plan
Setting	National outreach***: university centre to regional oncology networks	International outreach***: experts support oncology treatment in another country	Consultancy for specific expertise for rare tumours	Regional network specific collaboration	Regional network: cancer centre with general hospital	Regional network: cancer centre with general hospital
Patient travel	No	No	No	No	Prevent unnecessary travel	Yes, to location of scarce facility; triage via VC-MDTM
Responsibility for care	Advice on diagnostic and treatment plan	Advice on diagnostic and treatment plan	Treatment and palliative care in region	Palliative care in region	Coordinating patient care in region	Coordinating patient care in region
Treatment coordination	Own patients and sometimes referral to scarce facility	Own patients	Own patients	Specialised nurses provide care for own patients	Own patients	Refer patients to each other
Frequency	Diverse (daily - monthly)	Monthly (1 study thrice per week)	Bi-weekly (4 studies weekly)	Weekly (1 study Monthly)	Weekly (1 study monthly)	Weekly

Legend

- # = number of; MDT = multidisciplinary team, VC-MDTM = video-conferenced MDT meeting.
- * the MDT specialists are more or less equivalent in terms of experience, detailed techniques may differ depending on experience or specialist preference;
- ** medical oncologists and surgeons refer patients, if necessary, to each other after a VC-MDTM;
- *** outreach is the activity of providing services to any parts of the population that might not otherwise have access to those services.

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3 Firstly we reported benefits and drawbacks of four types of collaboration: Expert MDTM-
4 National, Expert MDTM-International, Expert Consultation and Consultation Specialist – Nurse (37
5 studies). Secondly, since the focus of this scoping review was on the collaboration of teams in regional
6 oncology network, we reported on the detailed mapping for MDT-Equal and MDTM-Collaborate (13
7 studies) (Table 3). We discussed the different topics with the amount of studies in which it is reported.
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11 The main benefits reported for the four types of collaboration (37 studies) for patients were:
12 better quality of life or survival (7 studies)^{5, 6, 9, 38, 55-57}, less travel (4 studies)^{27, 28, 35, 54}, eased diagnosis
13 and improved access to scarce treatment facilities such as radiotherapy (4 studies)^{27, 33, 37, 50}. The main
14 benefits reported for healthcare professionals: enhanced collaboration (25 studies)<sup>4-7, 28, 29, 32, 33, 36, 38, 41-
15 46, 48-54, 56, 57</sup>, improved multidisciplinary planning (19 studies)^{2, 6, 7, 27-29, 34-36, 40, 46, 48, 49, 52-57} and continued
16 medical education (20 studies)^{2, 4-6, 9, 29-31, 34, 38, 39, 44, 45, 48, 49, 53-57}. The reported drawbacks were more
17 diverse including increased workload for surgeons and delays due to having to wait on expert opinion;
18 10 studies did not report any drawbacks or barriers^{2, 29, 31, 35, 38, 40, 45, 48, 50, 55}.
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Outcomes other than benefits and drawbacks are shown in Table 1.

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
MDT-Equal					
Delaney et al. (2004) ¹	<u>Patient</u> : Improved access to multidisciplinary care. <u>HC</u> : improved access to multidisciplinary discussions; U-shaped table improved interaction between participants because they then face each other.	<u>HC</u> : More formalised and regimented professional relationships of MDs; 1 of the 2 district hospitals did not want to continue because of time constraints.	Liverpool Hospital, Sydney*: <u>MDt</u> : oncologist, radiotherapist; <u>MDd</u> : pathologist, radiologist; <u>Other</u> : medical students.	2 general district hospitals*: <u>MDt</u> : surgeon, oncologist, radiotherapist	HW: PictureTel Swiftsite-2, PictureTel Venue 2000 and PictureTel Concord 4500; SW: bridge support; bandwidth 384 Kbps.
Savage et al. (2007) ⁸	<u>Patient</u> : recommendations concerning major or minor changes to treatment plans for complex cases. <u>HC</u> : less travel for specialists; served as an educational tool.	<u>Patient</u> : less suitable for recruitment for clinical trials and research discussions. <u>HC</u> : less suitable for research discussions.	Centre, Glasgow*: <u>MDt</u> : ENT-, MF-surgeons, oncologists; <u>MDd</u> : radiologists, pathologists; <u>Sd</u> : specialist nurses, dieticians, speech and language therapists; <u>Other</u> : staff.	6 locations, West of Scotland Managed Clinical Network*: <u>MDt</u> : ENT-physician, oncologists; <u>Other</u> : staff.	Support: level of technical support varied across the locations.
Marshall et al. (2014) ⁵⁸	<u>HC</u> : served as an educational tool; logistics on services not available at remote partner are discussed.	<u>HC</u> : costs were an implementation barrier.	Michael E. DeBakey Veterans Affairs Medical Center, Houston: <u>MDt</u> : oncologists, radiotherapist, surgeon, gastroenterologist; <u>MDd</u> : pathologists, radiologists, nuclear medicine physician; <u>Other</u> : medical administration.	New Orleans (NOLA): <u>MDt</u> : oncologists, radiotherapist, pulmonologist; <u>MDd</u> : radiologist; <u>Other</u> : medical administration.	HW: high-resolution VC equipment. SW: Veterans Affairs linked IP-lines. Room: 1 th screen for real-time VC interactions, 2 nd screen for sharing EMR data and case presentations. Faults: audio quality slightly less than FTF.
Alexandersson et al. (2018) ⁵⁹	<u>Patient</u> : better treatment plans for complex cases. <u>HC</u> : gave shared culture and common understanding of cancer pathways in the networks; medical protocol and peer-review principles were advocated.	<u>HC</u> : estimated cost of VC-MDTM was higher than MDTM, but there was no account taken for reduced time for travel.	University hospital, Lund: [22 MDTMs, 13 VC] <u>MDt</u> : surgeons, oncologists; <u>MDd</u> : pathologists, radiologists; <u>Sd</u> : nurses.	6 county hospitals: [28 MDTMs, 11 VC] <u>MDt</u> : surgeons, oncologists; <u>MDd</u> : pathologists, radiologists; <u>Sd</u> : nurses.	<i>Not reported.</i>
Van Huizen et al. (2019) ⁶⁰	<u>Patient</u> : better treatment plans for complex cases due to discussion with 'fresh team'. <u>HC</u> : kept viewpoints on medical protocols aligned in the network.	<u>HC</u> : partner could not choose which patients to discuss due to the Dutch standard requiring the partner to discuss all patients with the centre; VC is an extra MDTM for the network.	University Medical Center Groningen: <u>MDt</u> : ENT-, MF-surgeons, radiotherapist.	Medical Centre Leeuwarden: <u>MDt</u> : ENT-, MF-surgeons, radiotherapist.	HW: <u>centre</u> : 3 beamers; 5 camera inputs; 4 PCs of which 1 dedicated for PACS; <u>remote partner</u> : 1 PC showing data and imaging. SW: 'Webex', optical fibre* bandwidth 2 Mbps. Room: U-shaped table*.

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
MDTM-Collaborate					
Hunter et al. (1999) ⁶¹	<p>Web-based</p> <p><u>Patient</u>: decreased unnecessary evacuations with cost savings.</p> <p><u>HC</u>: increased knowledge of clinical pathways for evacuation; stream-lined referral process with access to scarce facilities; served as an educational tool.</p> <p>ISDN</p> <p><u>HC</u>: promoted collaboration; participants could see each other; fewer administrative tasks to get information displayed at the remote partner.</p>	<p><u>HC</u>: hindered logistics of fixed day and time 1) the day of the week (100%), or 2) the time of day (97%), or 3) low volume of interesting case presentations (100%).</p> <p><u>HC</u>: hindered logistics of fixed day and time 1) day of the week (95%), or 2) time of day (85%), or 3) low volume of interesting cases discussed (81%).</p>	<p>Hawaii, Triple Army Medical Center:</p> <p><u>MDt</u>: surgeon, oncologist, radiotherapist;</p> <p><u>MDd</u>: pathologist, radiologist;</p> <p><u>Sd</u>: psychologist, specialist nurse;</p> <p><u>Other</u>: staff.</p> <p>NC, David Grant Medical Center:</p> <p><u>MDt</u>: surgeon, radiotherapist, oncologist;</p> <p><u>MDd</u>: pathologist, radiologist;</p> <p><u>Sd</u>: specialist nurse, social worker, technician;</p> <p><u>Other</u>: staff.</p>	<p>Guam, Okinawa, Misawa, Korea, Camp Lejeune, Yokota, Yokosuka:</p> <p><u>MDt</u>: surgeon;</p> <p><u>MDd</u>: pathologist, radiologist;</p> <p><u>Sd</u>: specialist nurse;</p> <p><u>Other</u>: staff.</p> <p>McClellan Air force base, Lemoore Naval:</p> <p><u>MDt</u>: surgeon;</p> <p><u>MDd</u>: radiologist;</p> <p><u>Sd</u>: specialist nurse;</p> <p><u>Other</u>: staff.</p>	<p>HW: VC system, film digitizer, archive, telepathology system, web server for radiology images, workstation, conferencing telephone, digital projectors.</p> <p>SW: net meeting desktop VC system.</p> <p>HW: microscope, film digitizer, web server, PCs, conferencing telephone; camera, microphones;</p> <p>SW: ISDN, bandwidth 384 Kbps, bridge support, PictureTel concord base codec; DICOM;</p> <p>Faults: when network congestion telephone conferencing is used.</p>
Olver et al. (2000) ¹⁰	<p><u>Patient</u>: satisfied with reduced time away from home; less travel for patients.</p> <p><u>HC</u>: better understanding treatment possibilities; better treatment planning; isolated MDs felt better supported; tertiary centre reported better communication with partners; less travel for MDs; enhanced peer review; served as an educational tool.</p>	<p><u>Patient</u>: no physical examination of patient; less confidentiality (privacy).</p> <p><u>HC</u>: not knowing each other or not knowing abilities of MDs at each site; increased workload of MDs; no reimbursement of VC.</p>	<p>Adelaide Royal:</p> <p><u>MDt</u>: oncologists, radiotherapist, palliative care clinicians;</p> <p><u>Sd</u>: nurses;</p> <p><u>Other</u>: staff.</p>	<p>Royal Darwin Hospital:</p> <p><u>MDt</u>: physicians, surgeons.</p>	<p>HW: centre: camera; cameras mounted above light box; microscope for radiology and pathology; <u>remote partner</u>: portable VC unit.</p> <p>Room: <u>centre</u>: 30-seat theatre;</p> <p>Faults: image quality;</p> <p>Support: logistics of displaying patient data.</p>
Davison et al. (2004) ⁶²	<p><u>Patient</u>: reduced waiting time from diagnosis to treatment; increased clinical trial accrual.</p> <p><u>HC</u>: format made case presentations more concise and complete; increased availability of thoracic surgeon opinion on recent guidelines; three weeks of surgeon travel time saved.</p>	<p><u>HC</u>: upload digital CT images had to be planned and conducted before the meeting by centre and partner.</p>	<p>Southend District Hospital:</p> <p><u>MDt</u>: chest medicine physician, oncologist,</p> <p><u>MDd</u>: radiologist;</p> <p><u>Sd</u>: specialist nurse, technician.</p>	<p>London Chest Hospital:</p> <p><u>MDt</u>: thoracic surgeon;</p> <p><u>MDd</u>: radiologist.</p>	<p>HW: Tandberg VC Vision 800; <u>centre</u>: Radworks CT viewing station; <u>partner</u>: Sony CCD camera; DXC950 above light-box;</p> <p>SW: 3 ISDN-lines, bandwidth 384 Kbps.</p> <p>Support: technician was necessary to adjust camera, sound and radiographs (enabling medical staff to concentrate on clinical issues).</p>

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
Kunkler et al. (2006) ⁶³	HC: increased size and composition of the group with less experienced, younger staff in VC vs FTF; less travel for specialists.	HC: during VC there is less knowledge available from experienced MDs, possibly due to logistic changes to the MDTM and difference in attendance.	Edinburgh Breast Unit: <u>MDt</u> : surgeons, oncologist; <u>MDd</u> : radiologists; <u>Sd</u> : specialist nurses; <u>Other</u> : staff.	Dumfries and Galloway Royal Infirmary: <u>MDt</u> : surgeons; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : specialist nurses.	**HW: Tandberg 2500 VC codec, twin digital projectors, networked PC, microscope and X-ray viewing system; SW: ISDN-lines, NHS IP networks and.
Kunkler et al. (2007) ⁶⁴	<u>Patient</u> : VC and FTF have similar clinical effectiveness in quality of decision making. HC: more core staff involved in the oncology centre VC vs FTF; less travel for specialists; better guideline compliance.	HC: slightly fewer cases by VC due to technical problems.	Edinburgh Breast Unit: <u>MDt</u> : surgeons, oncologists.	Queen Margaret Hospital, Dunfermline / Fife: <u>MDt</u> : surgeons; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : specialist nurses.	Room: U-form tables in room; Faults: 5x no VC due to technical difficulties. Support: improved access to required physical resources for VC vs FTF, but varied across locations.
Stevens et al. (2012) ⁶⁵	<u>Patient</u> : VC helped to decrease health disparities between urban and rural populations (improved access).	<u>Patient</u> : median time from diagnose to start treatment was longer (not significant).	Auckland District Health Board, VC-MDTM: <u>MDt</u> : surgeons, oncologists.	Counties Manukau District Health Board, VC-MDTM: <u>MDt</u> : respiratory physicians; <u>MDd</u> : radiologist.	<i>Not reported.</i>
Murad et al. (2014) ⁶⁶	<u>Patient</u> : impact on outcome through coordinated care. HC: refinement of treatment through discussion; specialists at both sites have developed closer professional ties and aligned common practices; guidelines better followed for chemotherapy before and after surgery; served as an educational tool.	HC: workload for oncological surgery increased threefold.	NORI Hospital, Islamabad: <u>MDt</u> : oncologists.	Holy Family Hospital, Rawalpindi: <u>MDt</u> : surgeons; <u>MDd</u> : radiologists and pathologists.	HW: Polycom VSX 7000 VTC camera, 42-inch liquid crystal display monitor. SW: VC link using DSL connectivity.
Novoa et al. (2016) ³	<u>Patient</u> : less travel for patients; increased frequency of thoracic surgery for new patients. HC: reduction in time for MD to see patients; reduction in duplicate tests; faster and more accurate diagnostic / treatment plans.	HC: too many patients to discuss during VC, but not all outpatients for thoracic surgery should be discussed in VC.	Healthcare Complex of the University of León*: <u>MDt</u> : thoracic surgeons.	Thoracic Surgery of University Hospital, Salamanca*: <u>MDt</u> : pulmonologists, oncologists, radiotherapists.	***HW: computer with microphone and webcam. SW: corporate application to access each other's' computer desktop.
			Healthcare Complex of the University of León*: <u>MDt</u> : thoracic surgeons, radiotherapists.	Hospital Nuestra Señora de Sonsoles de Ávila*: <u>MDt</u> : pulmonologists, oncologists.	

Legend
Abbreviations: ENT = Ear-Nose-Throat; FTF = face-to-face in the flesh; HC = Healthcare professional; MD = Medical Doctor; MDTM = Multidisciplinary Team Meeting; MF = Maxillofacial; pub = publication; RT = Radiotherapy; VC = Videoconferenced-MDTM; * from corresponding author.
Teams: MDt: MDs in therapeutic disciplines: surgeons, (medical) oncologists and radiotherapists; MDd: Medical Doctors in diagnostic disciplines: radiologist, pathologist, nuclear medicine physician; Sd: diverse disciplines related to treatment and palliative care: nurses, dieticians, etc; Other: staff, medical secretaries and medical administration; see supplement 5.

PC Platform: CCD = charge-coupled device camera; DICOM = Digital Imaging and Communications in Medicine; EMR = Electronic Medical Record; HW = hardware; ISDN = Integrated Service Digital Network; M / Kbps = Mega / Kilobits per second; PC = personal computer; TCP / IP = Transmission Control Protocol / Internet Protocol; SW = software; PACS = picture archiving & communication system. ** Kunkler's studies used the same VC-Platform; *** Novoa described two MDTMs that use the same VC-Platform. If authors had not clearly stated the data sources, the text in *italics* is the interpretation made by the authors of this review. Where we could not retrieve information, we put '*Not reported*'.

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Table 4: Mapping of benefits and drawbacks for MDT-Equal and MDTM-Collaborate

MDT-Equal	Regional oncology network	MDTM-Collaborate
Complex case discussion, optimised treatment plans (5/5)	Multidisciplinary discussion (13/13)	Form a single MDTM to draw up treatment plan (8/8)
Recommendations given and enhanced coordination of care (3/5)	Improved coordination of care (11/13)	Improved access to scarce facilities, enhanced coordination of care (8/8)
Align protocols, peer review (2/5)	Training on-the-job (5/13)	Improved compliance to standards and guidelines (7/13)
	Less travel MDs (6/13)	Less travel for patients (2/8)
Insurance companies favour lower cost (1/5)		Reduced cost VC, less than F2F (3/8)
Additional VC increased workload (2/5) Integrate VC in onsite MDTM	Difficult getting information complete (9/13) Format case presentations (5/13)	Equipment flaws (3/5) Technical support
VC less suitable for research (1/5)	Administrative workload increased (5/13)	VC required attendance is troublesome (2/5)
Professional relationships decreased (1/5) U-shaped table	Costs / no reimbursement (3/13)	VC reduced confidentiality (1/5)
Benefits; drawbacks with solutions		

VC in regional oncology networks

Similarities in benefits and drawbacks for the regional oncology network that occurred in both network types are first described and thereafter those that only applied to one type (Table 4 and Supplement 5).

Benefits

VC enhanced multidisciplinary discussions between specialists and other healthcare professionals on diagnostic and treatment plans in all 13 studies where this was investigated^{1, 3, 8, 10, 58-66}. VC strengthened their collegial networks, or established new partnerships, resulting in virtual management of regional oncology networks. In this way, VC facilitated collegial support and reduced professional isolation. VC was shown to reduce travel for specialists (6 studies)^{3, 8, 59, 62-64}, although only two studies evaluated costs in detail^{58, 59}.

Care coordination was considered to be improved (11 studies)^{1, 3, 8, 10, 58, 60-63, 65, 66}. VC discussions on complex cases were considered educational for younger specialists and were a form of on-the-job training (5 studies)^{8, 10, 58, 61, 66}. Most studies reported that MDTM participants would be willing to replace face-to-face meetings to discuss treatment plans for their patients with VC-MDTMs if the benefits outweighed the drawbacks and the technology would support it at lower costs^{1, 3, 8, 10, 58-63, 65, 66}.

Drawbacks and solutions

It was difficult to get all the information needed in time for case presentations before the VC, and workload increased as more cases were registered over time (9 studies)^{1, 3, 10, 58-60, 62, 64, 66}. Using a structured format to gather information made case presentations more concise and complete, and it reduced this problem. Discussions in MDTs were found to be time consuming and MDT members questioned whether all cases should be presented, as in the guidelines, or only complex cases that would benefit patients by optimising treatment plans (5 studies)^{3, 59-61, 66}. The costs of VC equipment and the lack of reimbursement were reported as an implementation barrier, although some insurance companies were willing to discuss reimbursement if VC costs would be lower than face-to-face (3 studies)^{10, 58, 59}. The administrative workload increased because digital CT images had to be transmitted to a viewing station, which had to be planned and executed by all teams involved before a meeting (5 studies)^{10, 58, 61, 62, 64}. Also, the available bandwidth could not be used for both data and video (images and sounds) at the same time.

VC in MDT-Equal

Benefits

Using videoconferencing between equal teams led to optimised diagnostic or treatment plans for complex cases and provided easy access to second opinions (5 studies)^{1, 8, 58-60}. Recommendations

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given during videoconferencing to treatment plans resulted in less correspondence between MDT members (3 studies)^{8, 59, 60}. VC was also used for aligning protocols, with peer review principles being used to stimulate working according to oncology guidelines (2 studies)^{59, 60}. VC between collaborating institutes within a region was stimulated by the health insurance company favouring VC if it lowered costs (1 study)⁵⁹.

Drawbacks and solutions

In the collaboration of a cancer centre with its partner, holding three MDTMs weekly (two face-to-face onsite MDTMs and one VC-MDTM) was seen as time consuming in terms of preparing, making notes and taking additional actions (2 studies)^{59, 60}. It was proposed to integrate the VC into the institutional MDTMs by standardising the meeting formats⁶⁰. Professional relationships between members with different disciplines decreased, resulting in less sharing of uncertainties and less inclination to think of ways to collaborate for the benefit of the patient. When the participants faced each other (across a U-form table) and after VC training, interaction between the different specialisms improved (1 study)¹. VC was considered less suitable for research discussions and for including patients in clinical trials (1 study)⁸.

VC in MDTM-Collaborate

Benefits

VC also helped specialists in oncology networks that required each other to bring together all the disciplines needed to draft diagnostic, or collaborate over, treatment plans to form a single MDTM. Using videoconferencing could help them plan with the patient and avoid unnecessary travel for patients (8 studies)^{3, 10, 61-66}. VC facilitated the access of patients from rural communities to scarce, urban facilities such as radiotherapy units (8 studies)^{3, 10, 61-66}. VC enhanced care coordination through case management that could identify the best treatment in a timely manner. VC enabled MDTs to meet national standards and guidelines when addressing rare tumours (7 studies)^{10, 61-66}, of those studies only three evaluated VC in relation to waiting times^{3, 61, 62}. VC reduced travel for patients (2 studies)^{3, 10}.

Drawbacks and solutions

Equipment problems had occurred during project start-up but these were reduced by technical support (3 studies)^{61, 62, 64}. Ensuring the attendance of the mandatory specialisms required to fulfil guideline compliance could prove troublesome (2 studies)^{3, 64}. Other drawbacks of VC were reduced confidentiality and not having the possibility to examine a patient. Privacy issues should be addressed in guidelines (1 study)¹⁰.

DISCUSSION

We have provided an overview of current VC use by collaborating teams in oncology networks. Six different types of team collaborating through VC were distinguished in oncology care: Expert MDTM-National, Expert MDTM-International, Expert Consultation, Consultation Specialist - Nurse MDT-Equal and MDTM-Collaborate. With the first four types, the main benefits for patients were less travel to get a diagnosis and treatment plan and improved access to scarce treatment facilities. For the healthcare professionals in the collaborating teams, the main added value reported was the ability to consult experts on complex cases and rare tumours, less travel resulting in less costs for the institution, improved care planning and continued medical education. The main reported barriers preventing the implementation of VC were time schedule conflicts, the costs of VC equipment if not fully utilised by other groups and delays due to waiting for expert consultations. For the MDT-Equal type, VC constituted an additional MDTM held to discuss complex cases and provide optimised treatment for these patients. For the MDTM-Collaborate type, VC enabled specialists to form a single MDTM that included the complementary specialisms required to meet guidelines, and resulted in their patients getting access to treatment in scarce facilities. For both types, the most important benefits were enhanced coordination of care and on-the-job training compared to the situation with only face-to-face MDTMs at the collaborating locations or institutes.

Some of the benefits and drawbacks were not unique to the MDT-Equal or MDTM-Collaborate types, they were also reported in studies addressing the other four types. The sustainability of VC was determined by the way the different teams collaborated, how well they knew each other, and how well VC was embedded in the organisation. The perceived benefits and the behaviour of members in overcoming barriers and finding solutions together were helpful in gaining VC acceptance. Some papers reported reduced efficiency^{1, 58, 59}, although others reported more cases being discussed in a VC than a face-to-face MDTM due to more efficient discussions^{3, 64}. During VC meetings, behaviour tended to become more formal and the different disciplines would merely state their views, and not help each other to formulate an optimal treatment plan for the patient. This behaviour could result in using more time than necessary to discuss a patient. However, if the teams met each other physically at least once a year and received VC training, this would consolidate feelings of solidarity and the VC communication between the teams improved^{1, 10, 60, 67, 68}. To summarise, a well-functioning MDTM, either by VC or face-to-face, requires the active participation of qualified and effective experts and optimised functioning in terms of format, structure, case selection and presentation, review, leadership and interaction between the participants⁶⁹.

The benefits gained by discussing complex cases would be enhanced if the MDTs could choose which cases to focus upon, but several European guidelines require all patients to be discussed in an MDTM^{59, 60, 62}, whether it is through video-conferencing or face-to-face. There are also no standardised formats or guidelines worldwide for MDTMs, although some countries have evaluated and then standardised formats for MDTMs that include VC use^{13, 70}. These can, for instance, require

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completing an electronic form prior to the start of the MDTM that is then summarised at the start of the group discussion on a patient.

This review has shown that exploiting VC can lead to the better use of staff time compared to face-to-face meetings by reducing the time spent travelling, although some studies cautioned that VC preparation required additional extra time. Elsewhere, the costs of VC equipment and the lack of reimbursement mechanisms were reported to be an implementation barrier⁷¹. It was noted that insurance companies favour VC if it lowers costs⁵⁹. However, if the value of VC is to be assessed including associated costs, the balance should also take account of the societal impact of improved health and wellbeing of patients in rural areas^{65,72}.

All over the world, collaborating teams in oncology networks now use VC to: 1) bring evidence-based care to the best place for a patient to receive it; 2) discuss complex cases and rare tumours; 3) simultaneously and quickly inform and update all healthcare professionals involved in the treatment of an individual patient; and 4) share expertise to educate and provide on-the-job training. The role of opinion leaders was seen as important for the successful adoption of VC, to counter reservations on using VC, meticulous planning and cultivation of support is key to gaining and sustaining provider acceptance⁶¹.

In one study it was concluded that a speed of at least 2 Mbps is needed to simultaneously stream video, see each other and ‘walk through’ CT or MRI images. It was seen as essential during complex case discussions to be able to see each other and at same time the detailed patient data in order to be able to diagnose a patient, evaluate the tumour stage and draw up an optimal multidisciplinary treatment plan⁶⁰.

Most studies reported that participants would willingly replace face-to-face MDTMs with ones based on videoconferencing to discuss treatment plans for their patients if the benefits outweighed the drawbacks and the technology would deliver sufficient support at lower costs. However, as of 2018, only a minority of institutions in the USA had videoconferencing available (26%); although the majority would participate (57%) if it was available⁷¹. VC should be tailored to the local needs and the specific requirements for diagnosis and treatment that depend on the biology of the tumour^{38, 53}.

Limitations

We have analysed a broad range of studies that used different research designs, settings and methods. Some studies amounted to no more than project set-up descriptions. Often, research methods were not well described. In fact, if we had excluded all the studies that did not follow guidelines for reporting research, we would have been left with very few studies to review. As such, the value of the included studies for other researchers would have improved substantially if these guidelines had been followed^{19, 73}.

During the analysis of the data contained in the included studies, we saw that the methodology used in the studies and the description of results were often open to interpretation. This was addressed by having two reviewers read all the studies in detail and then extract data in an iterative process. Following this, the deduced information was mapped to provide an overview of benefits and drawbacks.

Recommendations

Based on the findings of this review, we have formulated practical recommendations for the use of VC by collaborating teams, which we list in three categories.

Organisation of collaboration

- Create institutional commitment with local leadership, coordination and dedicated time for VC-MDTM members^{10, 28, 34, 43}.
- Meet in person at least annually to discuss policies, improve knowledge, and to come to know and trust each other^{10, 60}.
- Evaluate your VC-MDTMs with a focus on⁵⁹:
 - o patient perspectives and
 - o strengthening the contributions of care personnel.
- Arrange the participation of qualified and effective experts⁵⁹.
- Organise weekly meetings and use a pre-meeting checklist to minimise delays in starting treatment³⁷.
- Organise administrative support so that physicians can concentrate on medical aspects and the number of cases to be discussed can be optimised^{58, 59, 61}.
- Tailor the videoconferencing to local needs and disease-specific aspects including diagnosis and the treatment phase depending on the biology of the tumour³⁸.

VC meeting logistics

- Run VC meetings within an established framework such as used with local MDTMs¹⁰.
- Ensure appropriate case selection ('admission rules')⁴⁸.
- Use a standardised format to present cases^{39, 59}.
- Minimise the impact on healthcare professionals' practices, minimise the workload in preparing for a VC meeting and respect traditional referral patterns¹⁰.

VC platform requirements

- VC platform with at least two cameras and microphones:
 - o U-form seating plan so as to face each other¹;

- bandwidth >2 Mbps⁶⁰.
- An ability to see, at the same time, on two screens:
 - participants for optimal personal interaction¹.
 - real time actual data, such as imaging, histology and required test results to verify the diagnosis, tumour stage and treatment options^{59, 60}.

Further research

Future research on VC should include pre- and post-designs. Team collaboration over decision-making for treatment plans and care coordination should be compared in face-to-face and VC situations. The benefits and drawbacks should be assessed using well-defined quantitative and qualitative criteria.

COVID-19 pandemic

The data analysis phase of this review coincided with the start of the COVID-19 pandemic. To help bring this pandemic under control, VC was introduced as a communication medium in various domains to avoid contamination between participants. As a result, there is now a higher acceptance of VC as an alternative to face-to-face meetings. VC has enabled multidisciplinary discussions on treatment plans, that otherwise would be difficult, to continue⁷⁴⁻⁷⁸. Given this rapid implementation, it is important to not only understand the benefits, but also acknowledge the drawbacks, of VC.

CONCLUSIONS

VC is nowadays used in decision-making by collaborating teams in oncology care regionally, nationally and internationally. It is aimed at sharing expertise for complex treatment or palliative care for specific tumours, and to coordinate care for adults, adolescents and children.

The main benefits for patients are less travel to obtain a treatment plan, better coordination of care, improved access to scarce facilities and treatment in their own community. The main benefits for healthcare professionals are optimised treatment plans for complex cases through multidisciplinary discussions and informing all healthcare professionals at the same time to enhance care coordination. VC also contributes to aligning protocols and continued medical education.

ADDITIONAL INFORMATION

Additional files

- Supplementary file 1: Protocol (13 pages).
- Supplementary file 2: Literature search strategies (3 pages).
- Supplementary file 3: Excluded full texts – reasons for exclusion (Table - 4 pages).
- Supplementary file 4: Number of papers vs countries vs continents (Figure - 1 page).
- Supplementary file 5: Mapping of disciplines present during VC (Table - 2 pages).

Competing interests statement

None of the authors have competing interests.

Author's contribution

The first and second authors were involved in developing the study concept and designing this scoping review. The third author was responsible for the search strategies. The first and second authors drafted the manuscript. The third, fourth and fifth authors were involved in the revision of the manuscript. All the authors have read and approved the final manuscript.

Authors description

Four authors are engaged at the University Medical Center Groningen (UMCG) which is developing patient-centred, integrated care pathways for various patient groups. The Quality and Patient Safety research group evaluates the implementation of care pathways and MDTMs in order to develop management-level indicators for the care pathways led by healthcare professionals. In addition to medical and logistic aspects, all laws and regulations concerning quality and patient safety have to be observed. The UMCG has an institutional ISO 9001 for Healthcare certificate and ISO 27001 Information Security certificate for their care, research and educational processes.

LvH works as a consultant on quality and patient safety for various care pathways seeking to implement improvements and is involved in the certification of these care pathways at the regional level. PUD works as a researcher in the field of rehabilitation and is an epidemiologist. SvdW is a frequently asked information specialist at the university medical library (UML) and advocates open access publishing. She is an expert on literature searches (systematic reviews), search strategy development, critically appraised topics, evidence-based medicine, biomedical databases, impact, UML collection and is an educational coordinator. KA chairs the Health Services Management & Organisation Department of the Erasmus School of Health Policy & Management. His research interest is quality improvement and value-based healthcare. JR was chair of the multidisciplinary Head and Neck Oncology Group of the UMCG for 30 years and chair of the Dutch Multidisciplinary Head and Neck Oncology Group for 8 years. The centralisation of head and neck cancer care in eight centres was completed under his leadership in 1993.

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Data sharing statement

Datasets will be available from the corresponding author on request.

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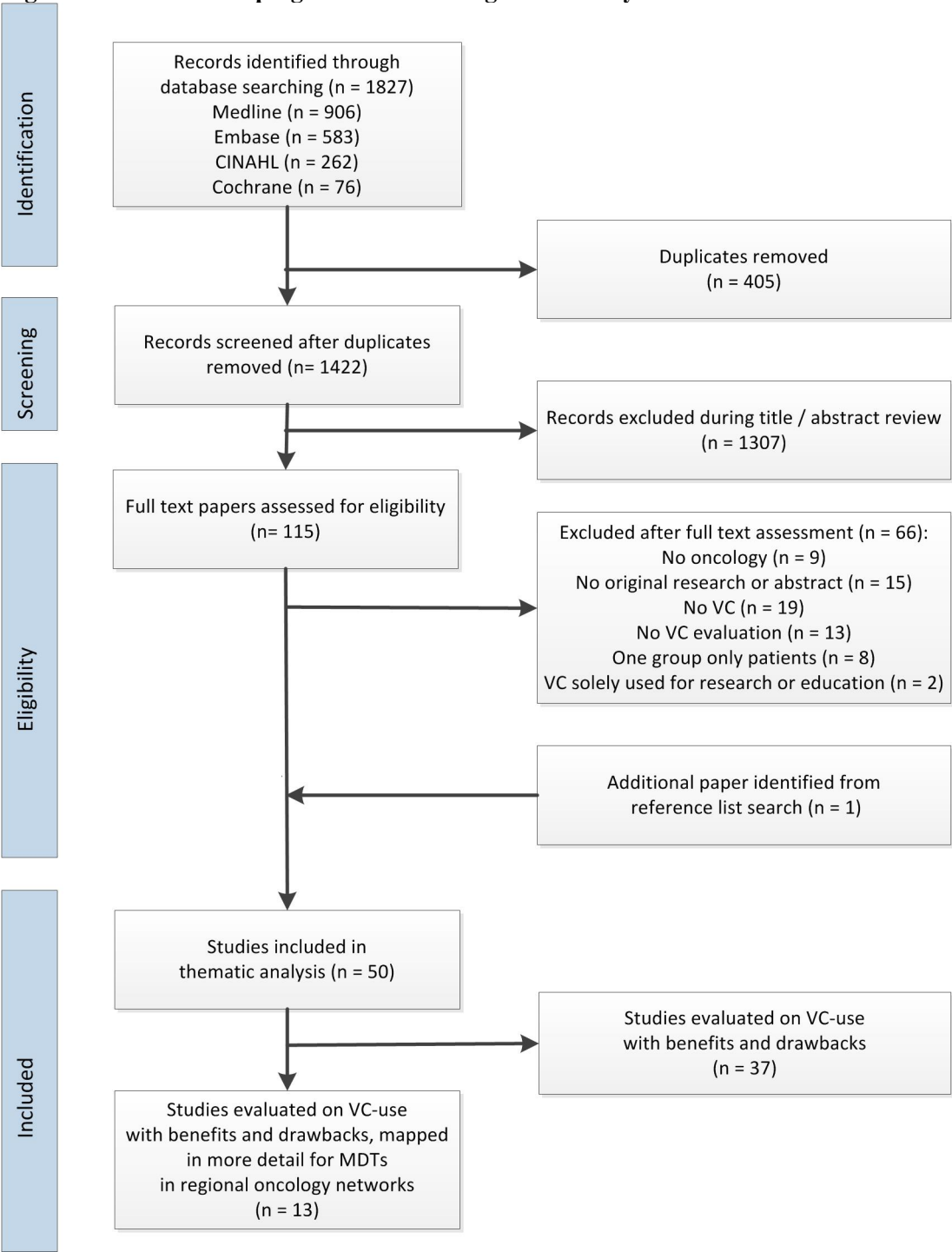
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Figure 1: PRISMA-Scoping-Review flow diagram of study selection





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PROTOCOL SCOPING REVIEW

How and why does videoconferencing add value to patient care and decision making when healthcare professionals working in teams at different locations use it.

A mixed approach of scoping and systematic review.

PROTOCOL SIGNATURE SHEET

Name	Signature	Date
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Epidemiologist: Prof. dr. P.U. Dijkstra		19-12-18



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Background

Videoconferencing is a commonly used technical tool for collaborating teams in regional oncology networks, but it is not often used in healthcare. Videoconferencing can be used for collaborating teams of healthcare professionals at different locations regarding patient care. We want to analyse settings in which videoconferencing is used as a medium of support for or replaces the multidisciplinary face-to-face meeting.



Review Questions

The aim of this scoping review is to describe and understand what the added value for patient care might be when healthcare professionals working in teams at different locations use videoconferencing for their decision making as compared to meeting face-to-face.

This review will focus on 5 sub questions:

1. What kind of videoconferencing between professionals working in teams are described in biomedical journals? (i.e. teams working within the same organisation, between organisations; with formal and informal status of collaboration)
2. What kind of performance is reached with videoconferencing as compared to a 'face-to-face' meeting '(i.e. number of patients discussed or recommendations given)?
3. What were outcome variables on which the videoconferences were evaluated with regard to added value (i.e. efficacy and successful communication)?
4. What factors have been identified that inhibit or enhance effective communication or success of the videoconferences (i.e. infrastructure, personnel / professionals working in groups)? Was additional communication used (i.e. Skype, e-mail, telephone)?
5. What kind equipment was used (i.e. availability of equipment, diagnostic features like imaging, monitor size)?

Methods

1. Searches

We will search PUBMED/Medline (American), Cinahl (Nursing and Allied Health), Embase (European), Cochrane. If contact authors will be contacted, the obtained information will be listed.

The search strategy is developed in collaboration with an experienced university librarian.

2. Search Strategy

The search strategy is given in appendix 1.

3. Inclusion / Exclusion criteria

We will show inclusions in the PRISMA-P-ScR-chart, see appendix 3.

Phase one

Inclusion criteria:

- all time spans
- all languages (if needed translation will be done)
- published papers describing videoconferencing
- videoconferencing for communication in Healthcare, between 2 or more groups (minimal number per groups = 2) of professionals at different sites aimed at collaboration over patient care

Exclusion criteria (we will show exclusions in the PRISMA-P-ScR-chart):

- reviews, letter to the editors, protocols
- no videoconferencing used
- e-Health,
- telemedicine
- educations purposes
- one professional to one other professional videoconferencing
- professional with patient(s) videoconferencing

Study quality will be assessed if possible by the EPOC (Effective Practice and Organisation of Care-Checklist) as used for Cochrane Reviews or the QI-MQCS questions (Quality Improvements – Minimal



Quality Criteria Set, Hempel et al 2015) to review how well the intervention is described or JBI (Joanna Briggs Institute Manual for scoping reviews, JBI 2015)¹.

4. Primary Outcome(s)

For healthcare professionals working in teams on different locations.

-primary outcomes:

- medical specialisms present during teleconferencing
- patient categories on which decision are made

-secondary outcomes:

- how do groups prepare for teleconferencing, is a protocol involved?
- what information is shared during teleconferencing (medical records of different types)?
- what topics are shared (e.g. complication- or incident registration; deviation of diagnostic or treatment plan)?
- patient information shown and referred to (e.g. diagnostic tests, imaging and history, treatment cure or palliative)
- equipment and applications used for teleconferencing and sharing information
- can participants see each other during videoconferencing when sharing patient data?
- are the same participants present during different sessions, is there a registration of participants?
- amount of patient cases in the study, are patients present during videoconferencing?

5. Data extraction (selection and coding)

In phase one the screening will be done by two researchers (LH and PD) who will independently assess titles and abstracts for in and exclusion criteria.

In the phase two the same review authors will assess the full text of the articles included in phase one (first screening) for the same in- and exclusion criteria. Reasons for exclusion will be registered. Matters of doubt will be discussed, until consensus is reached. If no consensus can be reached, a third independent assessor will give a binding verdict.

1

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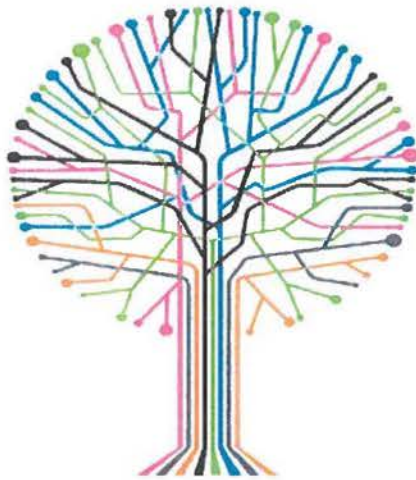


Figure: symbolic coding tree

In phase three data extraction will be undertaken independently by the two reviewers. Of each study general study characteristics will be collected concerning setting, design, unit of analysis, etc. The forms for 'screening and criteria' were developed and will be used for phase one, two and three. A pilot test with the screening form will be performed early in the first phase.

6. Risk of bias (quality) assessment

This scoping review will include different study types, therefore based on the included studies an appropriate quality assessment tool(s) will be selected and applied.

7. Strategy for data synthesis

The included articles will be summarized into tables regarding study and participant characteristics (author, publication, aim, partners / authors, methods, etc).

The flowchart chart (PRISMA) and overview chart will constitute a basis for the data analysis and narrative synthesis (mindmap with associations) in accordance with the integrative review method developed by Whittemore and Knafl and for the scoping part by Joanna Briggs.

The scoping review is an iterative process, when the first screening is performed the results will be discussed with members of the head & neck care pathway and tumour groups that use videoconferencing for their multidisciplinary meeting with their preferred partner.

The consensus of that discussion will be reported.

8. Analysis of subgroups or subsets

Where there are similarities in concept of evaluation videoconferencing and a sufficient number of studies (4 or more) is included, we will consider a meta-analysis. The subset of the papers found with the search strategy will be followed-up with a detailed search strategy to that specific topic. Where there are differences we will describe in a mind map similarities and differences.

Planning

Anticipated or actual start date is December 2018, anticipated completion date is September 2019.



Stage of review at time of this submission

The review has not yet started.

<u>Review stage</u>	<u>started</u>	<u>completed</u>
Preliminary searches	yes	yes
Piloting of the study selection process	yes	no
Formal screening of search results against eligibility criteria	no	no
Data extraction	no	no
Risk of bias (quality) selection	no	no
Data analysis	no	no

The design will be communicated together with an evaluation on added value of videoconferencing research of our centre to healthcare professionals that work together in the UMCG Oncology Committee.

The outcomes of the review will be communicated in the UMCG with the groups that use videoconferencing and in the Netherlands at different locations.

Abstract of the results will be presented in relevant seminars.

Furthermore we will publish the findings of this review in a peer reviewed journal.



Appendix 1: Search Strategies

PubMed

("Interprofessional Relations"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR interprofes*[tiab] OR inter-profes*[tiab] OR professional[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR multidisciplin*[tiab] OR multi-disciplin*[tiab] OR team[tiab] OR teams[tiab] OR tumor board*[tiab] OR tumour board*[tiab])

AND

("Telecommunications"[Mesh:NoExp] OR "Telemedicine"[Mesh] OR "Videoconferencing"[Mesh] OR videoconferenc*[tiab] OR video conferen*[tiab] OR teleconferenc*[tiab] OR tele-conferenc*[tiab] OR video record*[tiab] OR video facilit*[tiab] OR web conferen*[tiab] OR teleonco*[tiab] OR tele-onco*[tiab] OR

((online-based[tiab] OR webbased[tiab] OR web-based[tiab] OR computer-based[tiab] OR internet-based[tiab] OR virtual[tiab]) AND (communicat*[tiab] OR conferen*[tiab] OR meeting*[tiab] OR collaborat*[tiab] OR mdt[tiab] OR mdt[tiab]))

AND

("Neoplasms"[Mesh] OR "Cancer Care Facilities"[Mesh] OR "Medical Oncology"[Mesh] OR "Oncologists"[Mesh] OR "cancer" OR "cancers" OR oncolog* OR "tumor" OR "tumors" OR "tumour" OR "tumours" OR palliat* OR cancer[sb])

CINAHL (ebSCO)

((MH "Interprofessional Relations+") OR (MH "Multidisciplinary Care Team+") OR (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*"))

AND

((MH "Telecommunications") OR (MH "Teleconferencing") OR (MH "Videoconferencing+") OR (MH "Wireless Communications") OR (MH "Communications Software+") OR (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*")) OR

((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*))

AND

((MH "Cancer Care Facilities") OR (MH "Neoplasms+") OR (MH "Oncology+") OR (MH "Oncologists") OR cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*))

Embase (via embase.com)

('multidisciplinary team meeting'/exp OR 'interdisciplinary communication'/exp OR 'public relations'/exp OR 'multidisciplinary team'/de OR 'collaborative care team'/exp OR 'interpersonal communication'/de OR (interprofes* OR 'inter-profes*' OR professional OR interdisciplin* OR 'inter-disciplin*' OR multidisciplin* OR 'multi-disciplin*' OR team OR teams OR 'tumor board*' OR 'tumour board*'):ab,ti)

AND

('telecommunication'/de OR 'teleconference'/exp OR 'videoconferencing'/exp OR 'communication software'/exp OR (videoconferenc* OR 'video conferen*' OR teleconferenc* OR 'tele-conferenc*' OR 'video record*' OR 'video facilit*' OR teleoncol* OR 'tele-oncol*'):ab,ti OR

((online OR webbased OR 'web based' OR web OR computer OR internet OR virtual OR tele OR video) NEAR/8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*)):ab,ti)

AND

('neoplasm'/exp OR 'oncology'/exp OR 'oncologist'/exp OR 'cancer center'/exp OR 'oncologist'/exp OR (cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR



palliat*):ab,ti,de)
NOT
'conference abstract'/it

Cochrane Library (ti,ab,kw)
(interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*")
AND
(videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*" OR
((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video)
near (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)))
AND
(cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)



Appendix 2a: In- and exclusion criteria

<i>Eligible criteria phase one</i>		
<i>Selection criteria</i>	<i>Inclusion</i>	<i>Exclusion</i>
Study design	All study designs	Reviews not applicable, only original research
Settings, domain	Videoconferencing for communication in Healthcare, between 2 or more groups (minimal number per groups = 2) of professionals at different sites aimed at collaboration over patient care	Telemedicine, e-Health, Education purposes only
Settings, healthcare professionals - teams		Professional with patient(s) videoconferencing (if not Telemedicine); One professional to one other professional videoconferencing.
Equipment		No videoconferencing used or only communication with telephone or mail
Time Frame	All time spans	
Languages	All (if needed translation will be done)	



Appendix 2b: form screening title and abstract
Form selection abstract Scoping Review Videoconferencing (VC)
(form results will be marked on the abstract on paper and registered in Excel overview)

Try out will be performed on abstract numbers: 1, 11, 21, 31, 41, 51, 61, 71, 81, 91 and 101.

Refworks Number		
Assessor	<input type="checkbox"/> Lidia van Huizen	<input type="checkbox"/> Pieter Dijkstra
Date (of assessing)		
Title (first 3 words)		
Authors (first author)		
Year of publication		
Journal		

When answering questions: Black: if NO, stop; Red: of Yes, stop.

	Questions on in- and exclusion criteria	Yes	No	Not clear
1	Is the paper original research?			
2	Is VC described?			
3	Is the added value of VC described?			
4	Are participants Healthcare professionals?			
5	Does VC take place between 2 or more groups?			
6	Do the groups at each site or location consist of 2 or more participants?			
7	Is collaboration aimed at patient care or cure?			
8	Is telemedicine, e-Health or Education the only purpose of the VC?			
Remark?				



umcog

**Appendix 2c: form screening full text**

Part 2, full text, data extraction after abstract selection

<i>General Reviewers</i>	
Name	
Date (of extraction)	
<i>General information on title / abstract (Result presentation as in Table 1)</i>	
Title	
Authors	
Year publication, source	
Country	
Study location and context	
Study population and size / duration of study	
<i>Objective and methods (study design)</i>	
Aims of the study or objective	
Methodology or methods description	
Inclusion and exclusion criteria	
Methodology / data presented or obtainable	
Data collection period	
Sample size	
Equipment used	
Intervention type	
<i>Results, discussion and conclusions</i>	
Participants	
Key findings related review question	
Limitations of the study	
Other comments / remarks	
<i>Type of information</i>	
<i>Outcome characteristics</i>	
Setting of study	
Setting of participants	
Quality of evidence (specify)	
Is the value of VC discussed?	
<i>Structure of VC</i>	
Participants of videoconferencing (VC)	
EPOC 4: profession, level of training, clinical specialty (specify)	
Additional setting information	
Is the VC prepared?	
Are recommendations mentioned?	
Are changes in decisions due to the VC registered?	

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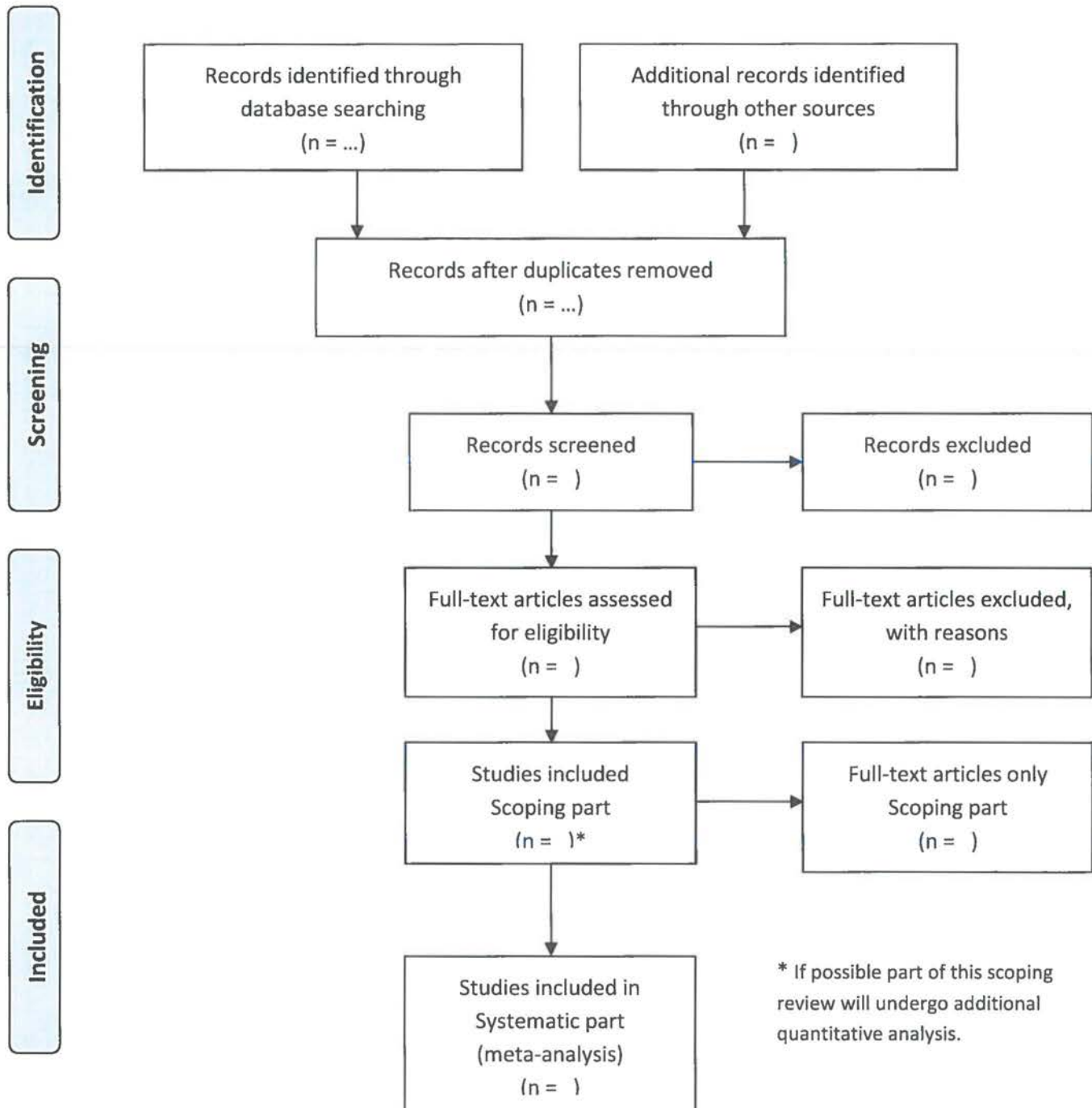
Is incident or complication discussion part of the agenda?	
<i>Outcome characteristics</i>	
If patients involved specify Purpose of videoconference	
Factors for successful videoconference	
Team collaboration	
Formal agreement	
Performance measurement?	
Criteria added value?	
Can participants see each other during interchange of patient information	
Other means of communications for participants besides videoconferencing in the same group?	
Results reported	
<i>Equipment</i>	
Equipment used How many sceens or computer monitors are available?	
Is it possible to show registrations in the medical records	



umcg



Appendix 3: PRISMA-ScR Flow Diagram Videoconferencing²



² From: 2017 Guidance for the Conduct of JBI Scoping Reviews, September 2017; In book: Joanna Briggs Institute Reviewer's Manual, Chapter: 11; Publisher: The Joanna Briggs Institute, Editors: Edoardo Aromataris, Zachary Munn; Project: [Guidance for the Conduct and Reporting of Scoping Reviews](#).

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Supplement 2: Search strategies

MEDLINE (PubMed)

("Interprofessional Relations"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR interprofes*[tiab] OR inter-profes*[tiab] OR professional[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR multidisciplin*[tiab] OR multi-disciplin*[tiab] OR team[tiab] OR teams[tiab] OR tumor board*[tiab] OR tumour board*[tiab])

AND

("Telecommunications"[Mesh:NoExp] OR "Telemedicine"[Mesh] OR "Videoconferencing"[Mesh] OR videoconferenc*[tiab] OR video conferen*[tiab] OR teleconferenc*[tiab] OR tele-conferenc*[tiab] OR video record*[tiab] OR video facilit*[tiab] OR web conferen*[tiab] OR teleonco*[tiab] OR tele-onco*[tiab] OR ((online-based[tiab] OR webbased[tiab] OR web-based[tiab] OR computer-based[tiab] OR internet-based[tiab] OR virtual[tiab]) AND (communicat*[tiab] OR conferen*[tiab] OR meeting*[tiab] OR collaborat*[tiab] OR mdt[tiab] OR mdts[tiab])))

AND

("Neoplasms"[Mesh] OR "Cancer Care Facilities"[Mesh] OR "Medical Oncology"[Mesh] OR "Oncologists"[Mesh] OR "cancer" OR "cancers" OR oncolog* OR "tumor" OR "tumors" OR "tumour" OR "tumours" OR palliat* OR cancer[sb])

CINAHL (EBSCO)

((MH "Interprofessional Relations+") OR (MH "Multidisciplinary Care Team+") OR TI (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*")) OR AB (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*"))

AND

((MH "Telecommunications") OR (MH "Teleconferencing") OR (MH "Videoconferencing+") OR (MH "Wireless Communications") OR (MH "Communications Software+") OR TI (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*")) OR TI ((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)) OR AB (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR

“tele-oncol*”) OR AB ((online OR webbased OR “web based” OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)))

AND

((MH "Cancer Care Facilities") OR (MH "Neoplasms+") OR (MH "Oncology+") OR (MH "Oncologists") OR cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)

Embase (embase.com)

('multidisciplinary team meeting'/exp OR 'interdisciplinary communication'/exp OR 'public relations'/exp OR 'multidisciplinary team'/de OR 'collaborative care team'/exp OR 'interpersonal communication'/de OR (interprofes* OR 'inter-profes*' OR professional OR interdisciplin* OR 'inter-disciplin*' OR multidisciplin* OR 'multi-disciplin*' OR team OR teams OR 'tumor board*' OR 'tumour board*'):ab,ti)

AND

('telecommunication'/de OR 'teleconference'/exp OR 'videoconferencing'/exp OR 'communication software'/exp OR (videoconferenc* OR 'video conferen*' OR teleconferenc* OR 'tele-conferenc*' OR 'video record*' OR 'video facilit*' OR teleoncol* OR 'tele-oncol*'):ab,ti OR ((online OR webbased OR 'web based' OR web OR computer OR internet OR virtual OR tele OR video) NEAR/8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)):ab,ti)

AND

('neoplasm'/exp OR 'oncology'/exp OR 'oncologist'/exp OR 'cancer center'/exp OR 'oncologist'/exp OR (cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*):ab,ti,de)

NOT

'conference abstract'/it

Cochrane Library (Cochrane reviews + Trials)

(interprofes* OR “inter-profes*” OR professional OR interdisciplin* OR “inter-disciplin*” OR multidisciplin* OR “multi-disciplin*” OR team OR teams OR “tumor board*” OR “tumour board”)

AND

(videoconferenc* OR “video conferen*” OR teleconferenc* OR “tele-conferenc*” OR “video record*” OR “video facilit*” OR teleoncol* OR “tele-oncol*” OR ((online OR webbased OR “web

based” OR web OR computer OR internet OR virtual OR tele OR video) near (communicat* OR
conferen* OR meeting* OR collaborat* OR mdt OR mds)))

AND

(cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour*
OR palliat*)

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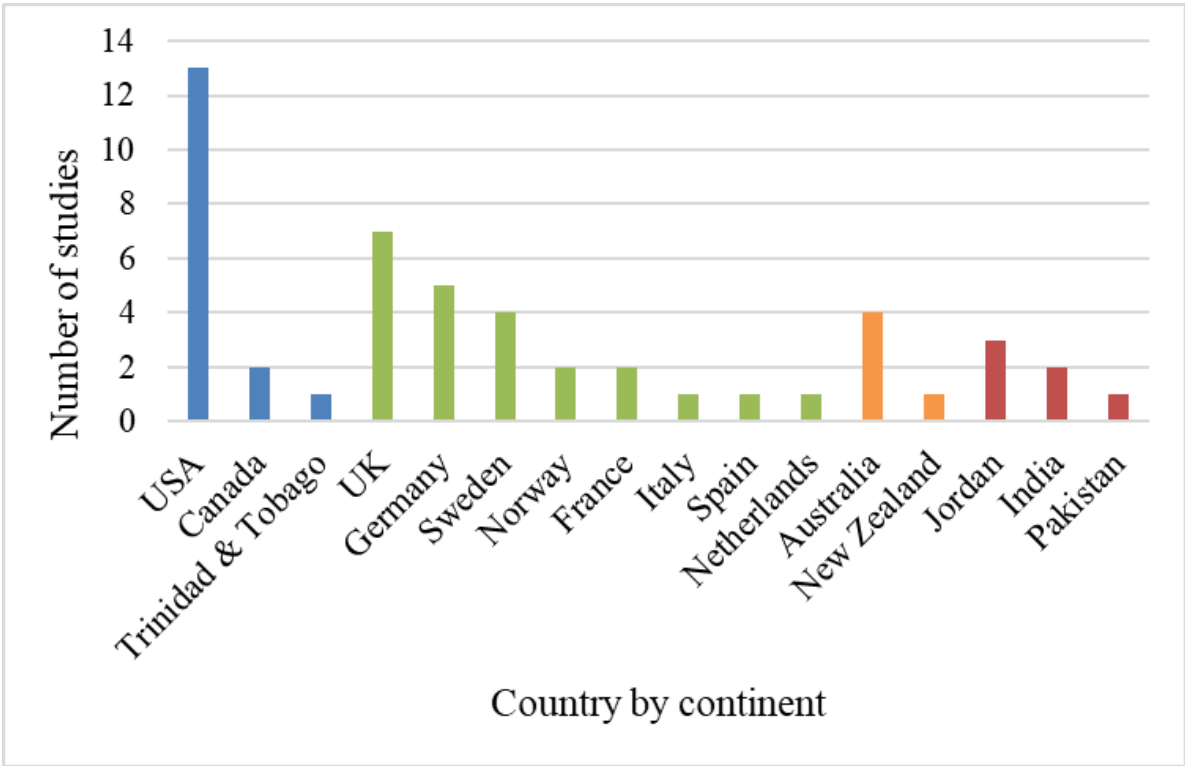
Supplement 3: Characteristics of excluded studies

<i>Authors</i>	<i>Year</i>	<i>World part, country</i>	<i>Reason for exclusion</i>
Burgess et al.	1999	USA	Videoconferencing specialist with patients
Atlas et al.	2000	Israel-USA	No structured evaluation of videoconferencing
Larcher et al.	2002	Italy	No videoconferencing
Mitchell et al.	2002	Australia	No cancer
Barry et al.	2003	UK	Answers to question 5 and 7 stays unclear
Gagliardi et al.	2003	Canada	Research only
Mitchell et al.	2005	Australia	No cancer
Pradeep et al.	2006	India	No structured evaluation of videoconferencing
Gagliardi et al.	2007	Canada	No videoconferencing
Lehoux et al.	2007	Canada	No cancer
Ashton et al.	2008	UK	Review
Ferrer et al.	2008	France	No videoconferencing
Mitchell et al.	2008	Australia	No videoconferencing
Qaddoumi et al.	2008	Jordan	No videoconferencing
Lewis et al.	2009	UK	Answers to question 5 and 7 stays unclear
Underhill et al.	2010	Australia	Education only
Vezzoni et al.	2011	Italy	Not primarily aimed at cancer treatment
Burns et al.	2012	Australia	Videoconferencing specialist with patients
Fitzpatrick et al.	2012	Canada	No videoconferencing
Washington et al.	2012	USA	Not primarily aimed at cancer treatment
Xilinas et al.	2012	USA	No videoconferencing
Langfeldt et al.	2013	Norway	No structured evaluation of videoconferencing
Chalabreysse et al.	2014	France	Videoconferencing specialist with patients
Francescutti et al.	2014	Canada	No videoconferencing
Holden et al.	2014	USA	Editorial
Berlanga et al.	2015	Spain	No videoconferencing
Gruttadauria et al.	2015	Italy	No cancer
Hue et al.	2015	France	No videoconferencing
Washington et al.	2015	USA	Not primarily aimed at cancer treatment
Garica Adrian et al.	2016	Spain	No cancer
Horton et al.	2016	USA	Abstract only
Wey Pang et al.	2016	UK	Abstract only
van Gurp et al.	2016	Netherlands	Videoconferencing specialist with patients
Pang et al.	2016	UK	Abstract only
Mascarenhas et al.	2017	Portugal – Netherlands	No structured evaluation of videoconferencing
Qaddoumi et al.	2017	Brazil	No videoconferencing
Cobb et al.	2018	UK	Abstract only
Ribelles et al.	2018	Australia	No structured evaluation of videoconferencing
Scott et al.	2018	USA	No structured evaluation of videoconferencing
Yu et al.	2018	China	No videoconferencing
Moss et al.	2019	UK	No videoconferencing
Nemecek et al.	2019	Austria	Videoconferencing specialist with patients
Terry et al.	2019	USA	Videoconferencing specialist with patients
Funderskov et al.	2019	Denmark	Videoconferencing specialist with patients
Jung et al.	2019	Australia	No videoconferencing
Abbasi et al.	2020	Pakistan	Editorial
Ambrosini et al.	2020	Italy	Videoconferencing specialist with patients
Anderson et al.	2020	Australia	Videoconferencing specialist with patients
Arlt et al.	2020	UK-Netherlands	Videoconferencing specialist with patients
Arrese et al.	2020	Chile	Editorial
Aseem et al.	2020	UK	Editorial
Dhamarajan et al.	2020	USA	No structured evaluation of videoconferencing
Doolittle et al.	2020	USA	No cancer
Elkaddoum et al.	2020	Lebanon	Editorial
Garcia Adrian et al.	2020	Spain	Abstract only

<i>Authors</i>	<i>Year</i>	<i>World part, country</i>	<i>Reason for exclusion</i>
Hellingman et al.	2020	Netherlands	No videoconferencing
Henderson et al.	2020	USA	No structured evaluation of videoconferencing
Kedia et al.	2020	USA	No videoconferencing
Perri et al.	2020	Canada	No cancer
Podda et al.	2020	Italy	No videoconferencing
Rajasekaran et al.	2020	UK	No structured evaluation of videoconferencing
Rangabashyam et al.	2020	Singapore	No videoconferencing
Rao et al.	2020	USA	No videoconferencing
Salari et al.	2020	Iran	Editorial
Triesman et al.	2020	USA	No structured evaluation of videoconferencing
Wiggins et al.	2020	UK	No structured evaluation of videoconferencing

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Supplement 4: Number of studies by continent and country



Legenda
This figure shows the number of studies by continent and by country where the teams were based that are described in the 50 studies included in the analysis.
Blue = North America (16 studies); Green = Europe (23 studies); Orange = Oceania (5 studies); Red = Asia (6 studies).

Supplement 5: Terms regarding healthcare professionals

Overview of the terms for healthcare professionals found in the different studies and how they were grouped by the authors in Table 3 of this review.

<i>Code</i>	<i>Term used in original paper</i>	<i>Equivalent group term (Table 3)</i>
Medical Doctor therapeutic (MDt)		
MDt	general surgeon	surgeon
MDt	plastic surgeon	surgeon
MDt	thoracic surgeon	surgeon
MDt	breast surgeon	surgeon
MDt	thoracic surgeon	surgeon
MDt	transplantation surgeon	surgeon
MDt	surgical oncologist +/- HPB	surgeon
MDt	ENT-surgeon	*ENT-surgeon
MDt	MF-surgeon	MF-surgeon
MDt	medical oncologist	oncologist
MDt	clinical oncologist	oncologist
MDt	gastroenterologist	gastroenterologist
MDt	hepatologist	hepatologist
MDt	treating physician	physician
MDt	general physician	physician
MDt	ENT-clinician	*ENT-physician
MDt	radiation oncologist	radiotherapist
MDt	pulmonologist	pulmonologist
MDt	respiratory physician	pulmonologist
MDt	internist	internist
MDt	Palliative Care (PC) clinician	PC physician
MDt	consultant chest medicine	thoracic physician
MDt	oncologic rehabilitation physician	rehabilitation physician
Medical Doctor diagnostic (MDd)		
MDd	radiologist	radiologist
MDd	diagnostic radiologist	radiologist
MDd	interventional radiologist	radiologist
MDd	pathologist	pathologist
MDd	nuclear medicine physician	nuclear medicine physician
MDd	medical physicist (supporting Nuclear Medicine)	medical physicist
Supportive Discipline (Sd)		
Sd	Macmillan cancer nurses oncology	specialist nurse
Sd	clinical nurse specialists in breast and colorectal cancer	specialist nurse
Sd	oncology nurse	specialist nurse
Sd	chemotherapy specialist nurses	specialist nurse
Sd	breast care nurses	specialist nurse
Sd	surgical nurse	specialist nurse
Sd	lung cancer clinical nurse specialist	specialist nurse
Sd	palliative care nurse	specialist nurse
Sd	nurse	nurse
Sd	extended practitioners (nurse practitioner / physician assistant)	specialist nurse
Sd	clinical trial nurses	research nurse
Sd	psychologist	psychologist
Sd	mammography technologist	technologist

<i>Code</i>	<i>Term used in original paper</i>	<i>Equivalent group term (Table 3)</i>
Sd	oncology art therapist	art therapist
Sd	radiographer	radiographer
Sd	respiratory therapist	respiratory therapist
Sd	dietician	dietician
Sd	speech & language therapist	speech & language therapist
Sd	junior medical staff	medical staff
Sd	staff physician	medical staff
Sd	social worker	social worker
Sd	medical dosimetrist	medical dosimetrist
Sd	genetic counsellor	genetic counsellor
Sd	nurse navigator	case manager
Sd	case manager	case manager
Other		
Other	research staff	research staff
Other	allied health staff	staff
Other	audit staff	staff
Other	other MDTM participants	staff
Other	project director	staff
Other	systems network manager	staff
Other	systems manager	staff
Other	dedicated coordinator	staff
Other	meeting coordinator	staff
Other	medical secretaries	medical administration
Other	administration	medical administration
Other	meeting coordinator	medical administration
Other	cancer registrar	medical administration
Other	cancer network coordinator	medical administration
Other	cancer centre personnel	medical administration
Other	technician	technician
Other	mammography technologist	technician
Other	trainees	students
Other	students	students

Legend people mentioned present at VC MDTM

* The terms ENT-physician and ENT-surgeon are seen as equivalents because, for ENT, the disciplines are the same. In comparison, neurosurgeons and neurologists have different disciplines. Abbreviations: ENT = Ear -Nose -Throat; MF = Maxillofacial; HPB = Hepatobiliary; VC = Videoconferencing; MDTM = Multidisciplinary Team Meeting.

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Title, page 1.
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Abstract, page 3.
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Introduction, page 4.
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Introduction, page 4.
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Method, page 5 and supplement 1.
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Method, page 5.
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Method, page 5.
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Method, page 5 and supplement 2.
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Method, page 5.
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Method, page 5 and 6.
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Method, page 6.
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not applicable for scoping reviews.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Method, page 6.
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Results, page 6 and Figure 1 – PRISMA-Scoping-Review flow diagram.
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Results, page 6 and supplement 4.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	See item 12, not applicable.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Results, page 7 - 10.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Results, page 7-10. Table 1, 2, 3 and 4 with supplement 5.
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Discussion, page 10.
Limitations	20	Discuss the limitations of the scoping review process.	Discussion, page 11.
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Conclusion, page 13.
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No funding

JB1 = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JB1 guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med.* 2018;169:467–473. doi: 10.7326/M18-0850.



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BMJ Open

Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2021-050139.R1
Article Type:	Original research
Date Submitted by the Author:	16-Sep-2021
Complete List of Authors:	van Huizen, Lidia; University Medical Centre Groningen, Quality and Safety; University Medical Centre Groningen, Oral and Maxillofacial Surgery Dijkstra, Pieter; University of Groningen, University Medical Center Groningen, Center for Rehabilitation van der Werf, Sjoukje; University of Groningen, University Medical Center Groningen, Central Medical Library Ahaus, Kees; Erasmus University Rotterdam, Erasmus School of Health Policy & Management, department Health Services Management & Organization Roodenburg, Jan; University of Groningen, University Medical Center Groningen, Oral and Maxillofacial Surgery
Primary Subject Heading:	Oncology
Secondary Subject Heading:	Paediatrics, Palliative care
Keywords:	ONCOLOGY, Adult oncology < ONCOLOGY, Paediatric oncology < ONCOLOGY, PALLIATIVE CARE, COVID-19

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TITLE

Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review

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KEY WORDS (max 6, current 5)
Added value, collaborating teams, multidisciplinary team meeting, regional oncology network, videoconferencing (MeSH term)

Wordcount (max 4000 – current ca. 3853, excluding title page, abstract, references, figures, tables and acknowledgments.)

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ABSTRACT (max 300 words; 293 words)

Introduction

Various forms of video-conferenced collaborations exist in oncology care. In regional oncology networks, multidisciplinary teams (MDTs) are essential in coordinating care in their region. There was no recent overview of the benefits and drawbacks of video-conferenced collaborations in oncology care networks. This scoping review presents an overview of videoconferencing (VC) in oncology care and summarises its benefits and drawbacks regarding decision-making and care coordination.

Design

We searched MEDLINE, Embase, CINAHL and the Cochrane Library from inception to October 2020 for studies that included VC use in discussing treatment plans and coordinating care in oncology networks between teams at different sites. Two reviewers performed data extraction and thematic analyses.

Results

Fifty studies were included. Six types of collaboration between teams using VC in oncology care were distinguished ranging from multidisciplinary teams collaborating with similar teams or with national or international experts to interactions between palliative-care nurses and experts in that field. Patient benefits were less travel for diagnosis, better coordination of care, better access to scarce facilities, and treatment in their own community. Benefits for healthcare professionals were optimised treatment plans through multidisciplinary discussion of complex cases, an ability to inform all healthcare professionals simultaneously, enhanced care coordination, less travel and continued medical education. VC added to the regular workload in preparing for discussions and increased administrative preparation.

Discussion

Benefits and drawbacks for collaborating teams were tied to general VC use. VC enabled better use of staff time and reduced the time spent travelling. VC equipment costs and the lack of reimbursement were implementation barriers.

Conclusion

VC is a highly useful for various types of collaboration in oncology networks and improves decision-making over treatment plans and care coordination, with substantial benefits for patients and specialists. Drawbacks are additional time related to administrative preparation.

STRENGTHS AND LIMITATIONS of this scoping review (max 5, current 4)

- Scoping review that identified benefits and drawbacks of videoconferencing for collaborating teams in oncology networks (strength).
- In-depth analysis with detailed mapping of multidisciplinary teams collaborating in regional oncology networks showing the benefits and drawbacks (strength).
- Organisational, logistical and technical recommendations for collaborating teams who want to consider or optimise videoconferencing usage (strength).
- The results of some included studies were open to possible misinterpretation because the aims and qualitative descriptions were often not clearly explained (limitation).

INTRODUCTION

In oncology care, there are different types of collaboration between teams when coordinating integrated care for their patients¹⁻⁴. Some teams treating rare tumours search out the expertise of specialised national and international experts who then share their knowledge. Some teams in palliative oncology care consult specialists while caring for patients in the last phase of their life. Further, multidisciplinary teams (MDTs, see list of abbreviations) in regional oncology networks are essential to provide a treatment plan and to coordinate care in their region. MDTs consist of specialists who focus on evidence-based treatment of patients. Oncology guidelines summarise the various key specialisms required for treating modalities surgery, medical oncology and radiotherapy, and for the different imaging specialisms depending on the biology of the tumour^{5, 6}.

In the 1990s, videoconferencing (VC) was introduced in oncology networks to address care pathways for high complexity - low volume care and for rare tumours. With VC, members of MDTs based in different locations but treating the same patient do not need to physically attend the multidisciplinary team meetings (MDTMs). Imaging, pathology and lab information could be shared during a VC session^{7, 8}. VC-MDTMs are often in addition to institution-based meetings, increasing workload and requiring coordination.

Scoping reviews are used to identify, retrieve and summarize literature relevant to a particular topic. They aim to identify and map the key concepts underpinning a research area, the main sources,

and types of evidence available⁹⁻¹¹. They typically do not include a process of quality assessment^{10, 12}. In an earlier scoping review of clinical applications of VC¹³, the characteristics of the studies included were summarised, but benefits and drawbacks were not evaluated. In a more recent review regarding e-health, VC was mentioned, along with its benefits and drawbacks, but not specifically for collaborating teams within oncology networks¹⁴. An overview of the benefits and drawbacks would be helpful for policymakers and for teams collaborating across different locations in deciding whether to introduce VC to improve care coordination, lower costs and reduce travel time.

The current scoping review was designed to provide an overview of different types of VC by teams collaborating in oncology networks. It then focussed on those MDTs that discuss diagnostic and treatment plans, and coordinate care within their regional oncology network. As such, our research questions were formulated as:

How does videoconferencing contribute to decision-making collaborating teams in oncology care at different locations?

What benefits and drawbacks of videoconferencing are perceived by MDTs in coordinating care in their regional oncology network?

METHOD

This review is reported according to the Preferred Reporting items for Systematic Reviews and Meta-Analysis for scoping reviews (PRISMA-Scoping-Review)¹⁵. The objectives, inclusion criteria and methods adopted in this scoping review were specified in advance and documented in a protocol (Supplement 1).

Sources and search strategy

We searched four electronic databases: MEDLINE (PubMed), Embase (embase.com), CINAHL (EBSCO) and the Cochrane Library, from inception of the databases to October 27th 2020. The searches were developed in collaboration with an information specialist (SvdW). The search strategies were based on three concepts: 1) multidisciplinary, 2) videoconferencing and 3) oncology. For each concept, a controlled vocabulary (including MeSH terms) and free-text terms were combined (Supplement 2). No time or language restrictions were applied. In addition to the database searches, the references of included studies were also screened for additional relevant articles.

Screening and selection

Two reviewers (LvH and PD) independently assessed titles and abstracts. If a title and abstract provided insufficient information, or the reviewers disagreed, the full text was assessed by the same

reviewers to determine inclusion. If the reviewers disagreed over a full-text assessment it was then discussed and, if no consensus was achievable, an independent reviewer (JR) provided a binding verdict.

Inclusion and exclusion criteria

To map different types of VC collaboration in oncology networks, we included studies if they were: 1) describing research on oncology care pathways, 2) original research, 3) full-text, 4) describing VC to communicate between teams at different locations, and 5) reporting benefits and drawbacks of VC use. Studies were excluded if: 1) VC was only used for telemedicine^{16, 17}, indicating one of the groups at a location were patients only; 2) VC was solely used for research or education, or 3) the article was a review, letter to an editor, or congress abstract.

Data extraction and analysis of subsets

Screening and selection

Two reviewers (LvH and PD) independently assessed titles and abstracts. If a title and abstract provided insufficient information, or the reviewers disagreed, the full text was assessed by the same reviewers to determine inclusion. If the reviewers disagreed over a full-text assessment it was then discussed and, if no consensus was achievable, an independent reviewer (JR) provided a binding verdict.

In Phase 1 of this scoping review, the following data were extracted for all the included studies: country of the teams using VC, aim of the study, research method and data source, number of cases discussed, number of VC and face-to-face MDTMs, benefits and drawbacks, frequency of VC-MDTMs, tumour type and study period. Based on these data, we performed a thematic analysis to distinguish different types of collaboration through VC. The similarities and differences were mapped by type.

Since we were particularly interested in the types of collaboration adopted within regional oncology networks, we mapped the specific types of VC collaboration in detail regarding similarities and differences, and summarised the reported benefits and drawbacks, the members of the MDTs who discuss diagnostic and treatment plans, and specifics of the VC platform used. In assessing the collaborating MDTs, we mapped VC participants for the cancer treatment's surgery, oncology and radiotherapy modalities, and described the VC Platform used.

If data were not sufficiently described in the paper reviewed, we looked in referred papers (describing the same study) or contacted the corresponding author via email, asking them to provide the missing information.

Patient and public involvement

This study was a scoping review on the use of VC by collaborating teams in oncology networks and therefore the study design did not seek patient and public involvement.

RESULTS

A total of 1422 unique records were identified (Figure 1). From this, 115 papers were selected for full text assessment, and one further paper was found in a reference list of an included study. After full text assessment, 50 studies remained for data extraction (Supplement 3).

[Insert here Figure 1: PRISMA-Scoping-Review: flow diagram of study selection]

Study characteristics

VC was described in 37 studies related to oncology treatment for adults, 5 studies for children and adolescents and 8 studies on palliative care. VC was most frequently described for teams working in the USA (n = 12), the UK (n = 7) and Germany (n = 5) (Supplement 4). In 11 studies, multiple types of tumours were treated, 12 focussed on breast cancer, 11 on gastro-intestinal cancer, 8 on lung cancer, 6 on head & neck cancer and 17 on various other specific cancer types (Supplement 5). The frequency of multidisciplinary meetings ranged from daily to monthly.

Considerable heterogeneity was found between the studies concerning research methods, data sources, primary outcome, and details of reporting. Four prospective studies of which 2 randomized controlled trials were included. Qualitative research methods (e.g. interviews and participating observations) and quantitative methods (e.g. surveys and database analysis) and as well as mixed methods were applied in the studies.

The most frequently used research method in the reported studies was review of databases, case records or VC notes (31 studies). A survey among healthcare professionals, or patients and their families, on the use of VC was also a frequently applied method (23 studies). In 23 studies, two or more data sources were combined. In some studies, the aims, methods and data sources were not clearly described; we deduced the most likely aims, methods and data sources, which are shown in *italics* in the tables.

Thematic analysis and synthesis of subsets

Six types of team collaboration in oncology care were distinguished (Table 1). Expert MDTM-National: providing expertise and experience on rare tumours nationally (17 studies)¹⁸⁻³⁴, 2) Expert MDTM-International: providing international expertise and experience on rare tumours (5 studies)³⁵⁻³⁹, 3) Expert Consultation: physicians caring for complex patients seeking a consultation with experts (11 studies)⁴⁰⁻⁵⁰, 4) Consultation Specialist – Nurse: nurses consulting with palliative treatment specialists

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3 in specialised palliative care units or hospices (4 studies)⁵¹⁻⁵⁴, 5) MDT-Equal: involving more-or-less
4 equal MDTs that use each other for a 'fresh look' to optimise the diagnostic and treatment plans for
5 complex cases (5 studies)⁵⁵⁻⁵⁹ and 6) MDTM-Collaborate: MDTs collaborating to form one MDTM (8
6 studies)⁶⁰⁻⁶⁷ (Supplement 5).
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9 We used the term 'MDT-Equal' for teams that had broadly equal expertise and know-how in
10 treating a specific type of patient. Here, the opting to use VC was to optimise treatment plans and to
11 coordinate care. To be classified as such a team, at least two key specialisms for diagnosing and
12 treatment and at least two 2 specialists needed to be present at each site. In comparison, the term
13 'MDTM-Collaborate' is used for teams that have complementary expertise and need each other to
14 make a complete team of experts to treat and to coordinate care for a specific type of patient. Together
15 the individual teams form an MDTM and, through this, comply with national legislation and oncology
16 guidelines.
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Table 1: Features of the types of VC collaboration identified in oncology networks

Legend
= number of; MDT = multidisciplinary team, MDTM = multidisciplinary team meeting; VC-MDTM = video-conferenced multidisciplinary team meeting.
* the MDT specialists are more or less equivalent in terms of experience, detailed techniques may differ depending on experience or specialist preference;
** medical oncologists and surgeons refer patients, if necessary, to each other after a VC-MDTM;
*** outreach is the activity of providing services to any parts of the population that might not otherwise have access to those services.

<i>Feature vs type</i>	<i>Expert MDTM-National</i>	<i>Expert MDTM-International</i>	<i>Expert Consultation</i>	<i>Consultation Specialist – Nurse</i>	<i>MDT-Equal*</i>	<i>MDTM-Collaborate**</i>
<i>Healthcare professionals in VC meeting</i>	Same type of specialists in national expert team discuss with MDTs at different locations via VC	Specialists of an MDT in one country give advice to and discuss with MDTs in a low-income country via VC	Specialists with expertise give advice via VC to treating physicians	Consultant for palliative care gives advice via VC to nurses in palliative care unit or hospice on care plan	Same type of specialists in MDTs at different locations discuss via VC	Complementary specialists at different locations together form a single MDTM via VC
<i># healthcare professionals</i>	≥ 2 each site	≥ 2 each site	1 or more	1 or more	≥ 2 each site	≥ 2 each site
<i>Purpose</i>	Provide expert opinion and advice on diagnostic or treatment plan	Provide expert opinion and advice on diagnostic or treatment plan	Provide expert opinion and advice on treatment plans	Provide medical specialist advice on care plans and incident handling	Optimize diagnostic or treatment plan made in onsite MDTM	Formulate diagnostic or treatment plan
<i>Setting</i>	National outreach***: university centre to regional oncology networks	International outreach***: experts support oncology treatment in another country	Consultancy for specific expertise for rare tumours	Regional network specific collaboration	Regional network: cancer centre with general hospital	Regional network: cancer centre with general hospital
<i>Patient travel</i>	No	No	No	No	Prevent unnecessary travel	Yes, to location of scarce facility; triage via VC-MDTM
<i>Responsibility for care</i>	Advice on diagnostic and treatment plan	Advice on diagnostic and treatment plan	Treatment and palliative care in region	Palliative care in region	Coordinating patient care in region	Coordinating patient care in region
<i>Treatment coordination</i>	Own patients and sometimes referral to scarce facility	Own patients	Own patients	Specialised nurses provide care for own patients	Own patients	Refer patients to each other
<i>Frequency</i>	Diverse (daily - monthly)	Monthly (1 study thrice per week)	Bi-weekly (4 studies weekly)	Weekly (1 study Monthly)	Weekly (1 study monthly)	Weekly

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3 Since the focus of this scoping review was on the collaboration of teams in regional oncology
4 networks, we reported on the detailed mapping for MDT-Equal and MDTM-Collaborate (13 studies,
5 Supplement 6). We discussed the different topics with the amount of studies in which it is reported.
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9 **Benefits and drawbacks of MDT-Equal and MDTM-collaborate**

10 VC in MDT-Equal and MDTM-Collaborate is aimed at collaboration in a regional oncology network.
11 First we will discuss common benefits and drawbacks related to the collaboration in a regional
12 oncology network and thereafter we will discuss the separate benefits and drawbacks of MDT-Equal
13 and MDTM-Collaborate (Table 2, Supplement 6 and Supplement 7).
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Table 2: MDT-Equal and MDTM-Collaborate, mapping of benefits and drawbacks

Legend
MDT: Multidisciplinary Team, MDTM = Multidisciplinary Team Meeting, VC = Videoconferencing.
Between brackets the number of studies reporting the benefit, drawback or solution.

MDT-Equal and MDTM-Collaborate (n=13)	MDT-Equal (n=5)	MDTM-Collaborate (n=8)
<u>Common Benefits</u>	<u>Benefits</u>	<u>Benefits</u>
Multidisciplinary discussion (13)	Complex case discussion, optimised treatment plans (5)	Form a single MDTM to draw up treatment plan (8)
Improved coordination of care (11)	Recommendations with enhanced care coordination (3)	Improved access to scarce facilities, enhanced coordination of care (8)
Training on-the-job (5)	Align protocols, peer review (2)	Improved compliance to standards and guidelines (7)
Less travel MDs (6)		Less travel for patients (2)
	Insurance companies favour lower cost (1)	Reduced cost VC, less than FtF (3)
<u>Common drawbacks with solutions</u>	<u>Drawbacks with solutions</u>	<u>Drawbacks with solutions</u>
Difficult getting information complete (9)	Additional VC increased workload (2)	Equipment flaws (3)
<i>Format case presentations (5)</i>	<i>Integrate VC in onsite MDTM</i>	<i>Technical support</i>
Administrative workload increased (5)	VC less suitable for research (1)	VC required attendance is troublesome (2)
Costs / no reimbursement (3)	Professional relationships decreased (1)	VC reduced confidentiality (1)
	<i>U-shaped table</i>	

Common benefits

VC enhanced multidisciplinary discussions between specialists and other healthcare professionals on diagnostic and treatment plans in all 13 studies where this was investigated⁵⁵⁻⁶⁷. VC strengthened their collegial networks, or established new partnerships, resulting in virtual management of regional oncology networks. In this way, VC facilitated collegial support and reduced professional isolation. VC was shown to reduce travel for specialists (6 studies)^{56, 58, 62-64, 67}, although only two studies evaluated costs in detail^{57, 58}.

Care coordination was considered to be improved (11 studies)^{55-57, 59-63, 65-67}. VC discussions on complex cases were considered educational for younger specialists and were a form of on-the-job training (5 studies)^{56, 57, 60, 61, 66}. Most studies reported that MDTM participants would be willing to replace face-to-face meetings to discuss treatment plans for their patients with VC-MDTMs if the benefits outweighed the drawbacks and the technology would support it at lower costs^{55-63, 65-67}.

Common drawbacks and solutions

It was difficult to get all the information needed prior to case presentations during VC, and workload increased as more cases were registered over time (9 studies)^{55, 57-59, 61, 62, 64, 66, 67}. Using a structured format to gather information made case presentations more concise and complete, and it reduced the workload. Discussions in MDTs were found to be time consuming and MDT members questioned whether all cases should be presented, as in the guidelines, or only complex cases that would benefit patients by optimising treatment plans (5 studies)^{58-60, 66, 67}. The costs of VC equipment and the lack of reimbursement were reported as an implementation barrier, although some insurance companies were willing to discuss reimbursement if VC costs would be lower than face-to-face (3 studies)^{57, 58, 61}. The administrative workload increased because digital CT images had to be transmitted to a viewing station, which had to be planned and executed by all teams involved before a meeting (5 studies)^{57, 60-62, 64}. Also, the available bandwidth could not be used for both data and video (images and sounds) at the same time.

Benefits of MDT-Equal

Using videoconferencing between equal teams led to optimised diagnostic or treatment plans for complex cases and provided easy access to second opinions (5 studies)⁵⁵⁻⁵⁹. Recommendations given during videoconferencing to treatment plans resulted in less correspondence between MDT members (3 studies)^{56, 58, 59}. VC was also used for aligning protocols, with peer review principles being used to stimulate working according to oncology guidelines (2 studies)^{58, 59}. VC between collaborating institutes within a region was stimulated by the health insurance company favouring VC if it lowered costs (1 study)⁵⁸.

Drawbacks and solutions of MDT-Equal

In the collaboration of a cancer centre with its partner, holding three MDTMs weekly (two face-to-face onsite MDTMs and one VC-MDTM) was seen as time consuming in terms of preparing, making notes and taking additional actions (2 studies)^{58, 59}. It was proposed to integrate the VC into the institutional MDTMs by standardising the meeting formats⁵⁹. Professional relationships between members with different disciplines decreased, resulting in less sharing of uncertainties and less inclination to think of ways to collaborate for the benefit of the patient (1 study)⁵⁵. When the participants faced each other (across a U-shaped table) and after VC training, interaction between the different specialisms improved (1 study)⁵⁵. VC was considered less suitable for research discussions and for including patients in clinical trials (1 study)⁵⁶.

Benefits of MDTM-Collaborate

VC also helped specialists in oncology networks that required each other to bring together all the disciplines needed to draft diagnostic, or collaborate over, treatment plans to form a single MDTM. Using videoconferencing could help them plan with the patient and avoid unnecessary travel for patients (8 studies)⁶⁰⁻⁶⁷. VC facilitated the access of patients from rural communities to scarce, urban facilities such as radiotherapy units (8 studies)⁶⁰⁻⁶⁷. VC enhanced care coordination through case management that could identify the best treatment in a timely manner. VC enabled MDTs to meet national standards and guidelines when addressing rare tumours (7 studies)⁶⁰⁻⁶⁶, of those studies only three evaluated VC in relation to waiting times^{60, 62, 67}. VC reduced travel for patients (2 studies)^{61, 67}.

Drawbacks and solutions of MDTM-Collaborate

Equipment problems had occurred during project start-up but these were reduced by technical support (3 studies)^{60, 62, 64}. Ensuring the attendance of the mandatory specialisms required to fulfil guideline compliance was troublesome (2 studies)^{64, 67}. Other drawbacks of VC were reduced confidentiality and not having the possibility to examine a patient. Privacy issues should be addressed in guidelines (1 study)⁶¹.

DISCUSSION

We have provided an overview of current VC use by collaborating teams in oncology networks. Six different types of team collaborating through VC were distinguished in oncology care: Expert MDTM-National, Expert MDTM-International, Expert Consultation, Consultation Specialist - Nurse MDT-Equal and MDTM-Collaborate. For the MDT-Equal type, VC constituted an additional MDTM held to discuss complex cases and provide optimised treatment for these patients. For the MDTM-Collaborate type, VC enabled specialists to form a single MDTM that included the complementary specialisms required to meet guidelines, and resulted in their patients getting access to treatment in scarce facilities. For both types, the most important benefits were enhanced coordination of care and on-the-

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3 job training compared to the situation with only face-to-face MDTMs at the collaborating locations or
4 institutes.

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6 Some of the benefits and drawbacks were not unique to the MDT-Equal or MDTM-
7 Collaborate types, they were also reported in studies addressing the other four types. The sustainability
8 of VC was determined by the way the different teams collaborated, how well they knew each other,
9 and how well VC was embedded in the organisation. The perceived benefits and the behaviour of
10 members in overcoming barriers and finding solutions together were helpful in gaining VC
11 acceptance. Some papers reported reduced efficiency^{55, 57, 58}, although others reported more cases being
12 discussed in a VC than a face-to-face MDTM due to more efficient discussions^{64, 67}. During VC
13 meetings, behaviour tended to become more formal and the different disciplines would merely state
14 their views, and not help each other to formulate an optimal treatment plan for the patient. This
15 behaviour could result in using more time than necessary to discuss a patient. However, if the teams
16 met each other physically at least once a year and received VC training, this would consolidate
17 feelings of solidarity and the VC communication between the teams improved^{55, 59, 61, 68, 69}. To
18 summarise, a well-functioning MDTM, either by VC or face-to-face, requires the active participation
19 of qualified and effective experts and optimised functioning in terms of format, structure, case
20 selection and presentation, review, leadership and interaction between the participants⁷⁰.

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22 The benefits gained by discussing complex cases would be enhanced if the MDTs could
23 choose which cases to focus upon, but several European guidelines require all patients to be discussed
24 in an MDTM^{58, 59, 62}, whether it is through video-conferencing or face-to-face. There are also no
25 standardised formats or guidelines worldwide for MDTMs, although some countries have evaluated
26 and then standardised formats for MDTMs that include VC use^{3, 71}. These formats can, for instance,
27 require completing an electronic form prior to the start of the MDTM that is then summarised at the
28 start of the group discussion on a patient. Also clearly defined roles of participants of VC is
29 important⁷⁰.

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31 This review showed that exploiting VC can lead to the better use of staff time compared to
32 face-to-face meetings by reducing the time spent travelling, although some studies cautioned that VC
33 preparation required additional extra time. Elsewhere, the costs of VC equipment and the lack of
34 reimbursement mechanisms were an implementation barrier⁷². It was noted that insurance companies
35 favour VC if it lowers costs⁵⁸. Besides these costs also societal impact of improved health and
36 wellbeing of patients in rural areas should be taken into account^{65, 73}.

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38 All over the world, collaborating teams in oncology networks now use VC to: 1) bring
39 evidence-based care to the best place for a patient to receive it; 2) discuss complex cases and rare
40 tumours; 3) simultaneously and quickly inform and update all healthcare professionals involved in the
41 treatment of an individual patient; and 4) share expertise to educate and provide on-the-job training.
42 The role of opinion leaders was seen as important for the successful adoption of VC, to counter
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reservations on using VC, meticulous planning and cultivation of support is key to gaining and sustaining provider acceptance⁶⁰.

In one study it was concluded that a speed of at least 2 Mbps is needed to simultaneously stream video, see each other and ‘walk through’ CT or MRI images. It was seen as essential during complex case discussions to be able to see each other and at same time the detailed patient data in order to be able to diagnose a patient, evaluate the tumour stage and draw up an optimal multidisciplinary treatment plan⁵⁹.

Most studies reported that participants would willingly replace face-to-face MDTMs with ones based on videoconferencing to discuss treatment plans for their patients if the benefits outweighed the drawbacks and the technology would deliver sufficient support at lower costs. However, as of 2018, only a minority of institutions in the USA had videoconferencing available (26%); although the majority would participate (57%) if it was available⁷². VC should be tailored to the local needs and the specific requirements for diagnosis and treatment that depend on the biology of the tumour^{29, 49}.

Limitations

This review included a broad range of studies that used different research designs, settings and methods. Some studies were project set-up descriptions. Often, research methods were not well described. In fact, if we had excluded all the studies that did not follow guidelines for reporting research, we would have been left with very few studies to review. As such, the value of the included studies would have improved substantially if these guidelines had been followed^{13, 74}.

During the analysis of the data contained in the included studies, we saw that the methodology used in the studies and the description of results were often open to interpretation. Therefore two reviewers read all the studies in detail and extracted data in an iterative process. Thereafter , the information was mapped to provide an overview of benefits and drawbacks.

Recommendations

Based on the review of studies, we have formulated practical recommendations for the use of VC by collaborating teams, which we list in three categories.

Organisation of collaboration

- Create institutional commitment with local leadership, coordination and dedicated time for VC-MDTM members^{19, 25, 34, 61}.
- Meet in person at least annually to discuss policies, improve knowledge, and to come to know and trust each other^{59, 61}.
- Evaluate your VC-MDTMs with a focus on⁵⁸:
 - o patient perspectives and

- strengthening the contributions of care personnel.
- Arrange the participation of qualified and effective experts⁵⁸.
- Organise weekly meetings and use a pre-meeting checklist to minimise delays in starting treatment²⁸.
- Organise administrative support so that physicians can concentrate on medical aspects and the number of cases to be discussed can be optimised^{57, 58, 60}.
- Tailor the videoconferencing to local needs and disease-specific aspects including diagnosis and the treatment phase depending on the biology of the tumour²⁹.

VC meeting logistics

- Run VC meetings within an established framework such as used with local MDTMs⁶¹.
- Ensure appropriate case selection ('admission rules')⁴⁸.
- Use a standardised format to present cases^{30, 58}.
- Minimise the impact on healthcare professionals' practices, minimise the workload in preparing for a VC meeting and respect traditional referral patterns⁶¹.

VC platform requirements

- VC platform with at least two cameras and microphones:
 - U-form seating plan so as to face each other⁵⁵;
 - bandwidth more than 2 Mbps⁵⁹.
- An ability to see, at the same time, on two screens:
 - participants for optimal personal interaction⁵⁵.
 - real time actual data, such as imaging, histology and required test results to verify the diagnosis, tumour stage and treatment options^{58, 59}.

Further research

Future research on VC should include pre- and post-designs. Team collaboration over decision-making for treatment plans and care coordination should be compared in face-to-face and VC situations. The benefits and drawbacks should be assessed using well-defined quantitative and qualitative criteria.

COVID-19 pandemic

The data analysis phase of this review coincided with the start of the COVID-19 pandemic. To help bring this pandemic under control, VC was introduced as a communication medium in various domains to avoid contamination between participants. As a result, there is now a higher acceptance of VC as an alternative to face-to-face meetings. VC has enabled multidisciplinary discussions on

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treatment plans, that otherwise would be difficult, to continue⁷⁵⁻⁷⁹. Given this rapid implementation, it is important to not only understand the benefits, but also acknowledge the drawbacks, of VC.

CONCLUSIONS

VC enables sharing expertise for complex treatment or palliative care for specific tumours, and to coordinate care for adults, adolescents and children.

Benefits for patients are less travel to obtain a treatment plan, better coordination of care, improved access to scarce facilities and treatment in their own community. Benefits for healthcare professionals are optimised treatment plans for complex cases through multidisciplinary discussions and informing all healthcare professionals at the same time to enhance care coordination. VC also contributes to aligning protocols and continued medical education.

The costs of VC equipment and the lack of reimbursement were reported as an implementation barrier. Also the administrative workload increased because digital CT images had to be transmitted to a viewing station, which had to be planned and executed by all teams involved before a meeting.

LIST OF ABBREVIATIONS

DDS	Doctor of Dental Surgery
ENT	Ear, Nose and Throat
FtF	Face-to-face (physically)
MD	Medical Doctor
MDT	Multidisciplinary Team
MDTM	Multidisciplinary Team Meeting
MF	Maxillofacial
MeSH	Medical Subject Headings
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PT	Physio Therapist
RT	Radiotherapy
RCT	Randomized Controlled Trial
UMCG	University Medical Center Groningen
USA	United States of America
UK	United Kingdom
VC	Videoconferencing

ADDITIONAL INFORMATION

Additional files

- Supplementary file 1: Protocol (13 pages)
- Supplementary file 2: Literature search strategies (3 pages)
- Supplementary file 3: Excluded full texts – reasons for exclusion (Table - 4 pages)
- Supplementary file 4: Number of papers vs countries vs continents (Figure - 1 page)
- Supplementary file 5: Descriptives regarding VC use (Table - 12 pages)
- Supplementary file 6: Benefits, drawbacks, VC team participants and VC platform used in MDT-Equal and MDTM-Collaborate videoconferencing (Table - 4 pages)
- Supplementary file 7: Mapping of disciplines present during VC (Table - 2 pages)

Competing interests statement

None of the authors have competing interests.

Author’s contribution

The first author (LvH) and the second author (PD) were involved in developing the study concept and designing this scoping review. The third author (SvdW) was responsible for the search strategies. After the search two reviewers (LvH and PD) independently assessed titles, abstracts and full texts. If the reviewers disagreed over a full-text assessment it was then discussed and, if no consensus was achievable, an independent reviewer, also the last author (JR) provided a binding verdict. The first and second authors (LvH and PD) extracted the data and thereafter drafted the manuscript. The third (SvdW), fourth (KA) and fifth author (JR) were involved in the revision of the manuscript. All the authors have read and approved the final manuscript.

Authors description

Four authors are engaged at the University Medical Center Groningen (UMCG) which is developing patient-centred, integrated care pathways for various patient groups. The Quality and Patient Safety research group evaluates the implementation of care pathways and MDTMs in order to develop management-level indicators for the care pathways led by healthcare professionals. In addition to medical and logistic aspects, all laws and regulations concerning quality and patient safety have to be observed. The UMCG has an institutional ISO 9001 for Healthcare certificate and ISO 27001 Information Security certificate for their care, research and educational processes.

LvH works as a consultant on quality and patient safety for various care pathways seeking to implement improvements and is involved in the certification of these care pathways at the regional level. PD works as a researcher in the field of rehabilitation and is an epidemiologist. SvdW is a frequently asked information specialist at the university medical library (UML) and advocates open access publishing. She is an expert on literature searches (systematic reviews), search strategy development, critically appraised topics, evidence-based medicine, biomedical databases, impact, UML collection and is an educational coordinator. KA chairs the Health Services Management &

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Data sharing statement

Datasets will be available from the corresponding author on request.

Ethical Statement

No ethical approval is needed because data from previous published studies in which informed consent was obtained by primary investigators were retrieved and analysed.

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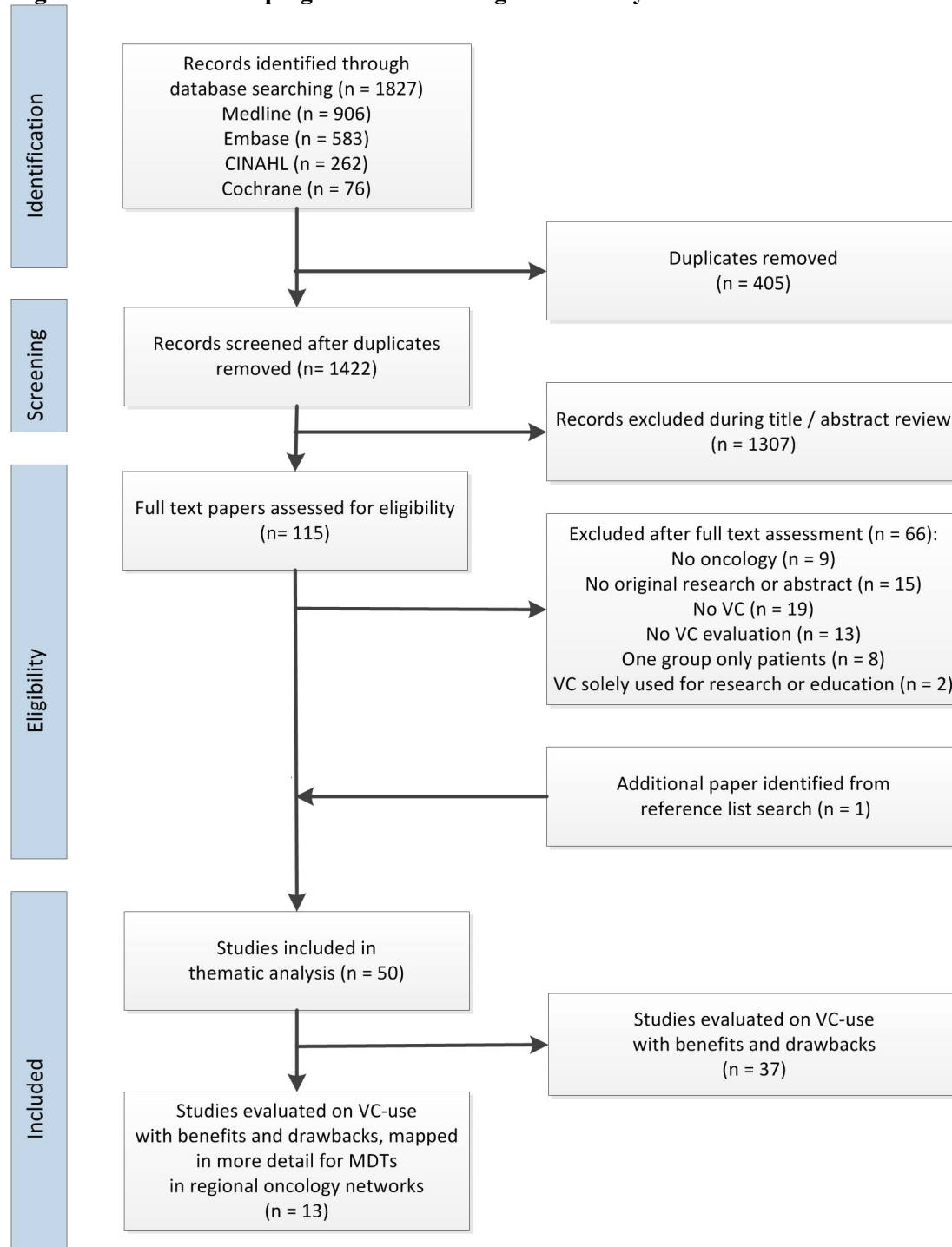
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Figure 1: PRISMA-Scoping-Review flow diagram of study selection



PROTOCOL SCOPING REVIEW

How and why does videoconferencing add value to patient care and decision making when healthcare professionals working in teams at different locations use it.

A mixed approach of scoping and systematic review.

PROTOCOL SIGNATURE SHEET

Name	Signature	Date
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Epidemiologist: Prof. dr. P.U. Dijkstra		19-12-18



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Background

Videoconferencing is a commonly used technical tool for collaborating teams in regional oncology networks, but it is not often used in healthcare. Videoconferencing can be used for collaborating teams of healthcare professionals at different locations regarding patient care.

We want to analyse settings in which videoconferencing is used as a medium of support for or replaces the multidisciplinary face-to-face meeting.



Review Questions

The aim of this scoping review is to describe and understand what the added value for patient care might be when healthcare professionals working in teams at different locations use videoconferencing for their decision making as compared to meeting face-to-face. This review will focus on 5 sub questions:

1. What kind of videoconferencing between professionals working in teams are described in biomedical journals? (i.e. teams working within the same organisation, between organisations; with formal and informal status of collaboration)
2. What kind of performance is reached with videoconferencing as compared to a ‘face-to-face’ meeting (i.e. number of patients discussed or recommendations given)?
3. What were outcome variables on which the videoconferences were evaluated with regard to added value (i.e. efficacy and successful communication)?
4. What factors have been identified that inhibit or enhance effective communication or success of the videoconferences (i.e. infrastructure, personnel / professionals working in groups)? Was additional communication used (i.e. Skype, e-mail, telephone)?
5. What kind equipment was used (i.e. availability of equipment, diagnostic features like imaging, monitor size)?

Methods

1. Searches

We will search PUBMED/Medline (American), Cinahl (Nursing and Allied Health), Embase (European), Cochrane. If contact authors will be contacted, the obtained information will be listed. The search strategy is developed in collaboration with an experienced university librarian.

2. Search Strategy

The search strategy is given in appendix 1.

3. Inclusion / Exclusion criteria

We will show inclusions in the PRISMA-P-ScR-chart, see appendix 3.

Phase one

Inclusion criteria:

- all time spans
- all languages (if needed translation will be done)
- published papers describing videoconferencing
- videoconferencing for communication in Healthcare, between 2 or more groups (minimal number per groups = 2) of professionals at different sites aimed at collaboration over patient care

Exclusion criteria (we will show exclusions in the PRISMA-P-ScR-chart):

- reviews, letter to the editors, protocols
- no videoconferencing used
- e-Health,
- telemedicine
- educations purposes
- one professional to one other professional videoconferencing
- professional with patient(s) videoconferencing

Study quality will be assessed if possible by the EPOC (Effective Practice and Organisation of Care-Checklist) as used for Cochrane Reviews or the QI-MQCS questions (Quality Improvements – Minimal



Quality Criteria Set, Hempel et al 2015) to review how well the intervention is described or JBI (Joanna Briggs Institute Manual for scoping reviews, JBI 2015)¹.

4. Primary Outcome(s)

For healthcare professionals working in teams on different locations.

-primary outcomes:

- medical specialisms present during teleconferencing
- patient categories on which decision are made

-secondary outcomes:

- how do groups prepare for teleconferencing, is a protocol involved?
- what information is shared during teleconferencing (medical records of different types)?
- what topics are shared (e.g. complication- or incident registration; deviation of diagnostic or treatment plan)?
- patient information shown and referred to (e.g. diagnostic tests, imaging and history, treatment cure or palliative)
- equipment and applications used for teleconferencing and sharing information
- can participants see each other during videoconferencing when sharing patient data?
- are the same participants present during different sessions, is there a registration of participants?
- amount of patient cases in the study, are patients present during videoconferencing?

5. Data extraction (selection and coding)

In phase one the screening will be done by two researchers (LH and PD) who will independently assess titles and abstracts for in and exclusion criteria.

In the phase two the same review authors will assess the full text of the articles included in phase one (first screening) for the same in- and exclusion criteria. Reasons for exclusion will be registered. Matters of doubt will be discussed, until consensus is reached. If no consensus can be reached, a third independent assessor will give a binding verdict.

1

1. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 2005, 8(1):19-32.
2. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implementation science: IS* 2010, 5:69.
3. Colquhoun HL, Levac D, O'Brien KK, Straus S, Tricco AC, Perrier L, Kastner M, Moher D. Scoping reviews: time for clarity in definition, methods, and reporting. *Journal of clinical epidemiology*, 67, 2014.
4. Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. *International journal of evidence-based healthcare* 2015, 13(3):141-146.; Joanna Briggs Guidance, comes with a supplement
5. Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMJ Medical Research Methodology*.

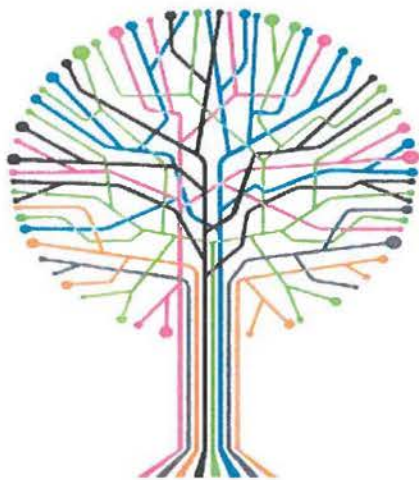


Figure: symbolic coding tree

In phase three data extraction will be undertaken independently by the two reviewers. Of each study general study characteristics will be collected concerning setting, design, unit of analysis, etc. The forms for ‘screening and criteria’ were developed and will be used for phase one, two and three. A pilot test with the screening form will be performed early in the first phase.

6. Risk of bias (quality) assessment

This scoping review will include different study types, therefore based on the included studies an appropriate quality assessment tool(s) will be selected and applied.

7. Strategy for data synthesis

The included articles will be summarized into tables regarding study and participant characteristics (author, publication, aim, partners / authors, methods, etc). The flowchart chart (PRISMA) and overview chart will constitute a basis for the data analysis and narrative synthesis (mindmap with associations) in accordance with the integrative review method developed by Whittemore and Knafl and for the scoping part by Joanna Briggs. The scoping review is an iterative process, when the first screening is performed the results will be discussed with members of the head & neck care pathway and tumour groups that use videoconferencing for their multidisciplinary meeting with their preferred partner. The consensus of that discussion will be reported.

8. Analysis of subgroups or subsets

Where there are similarities in concept of evaluation videoconferencing and a sufficient number of studies (4 or more) is included, we will consider a meta-analysis. The subset of the papers found with the search strategy will be followed-up with a detailed search strategy to that specific topic. Where there are differences we will describe in a mind map similarities and differences.

Planning

Anticipated or actual start date is December 2018, anticipated completion date is September 2019.



Stage of review at time of this submission

The review has not yet started.

<u>Review stage</u>	<u>started</u>	<u>completed</u>
Preliminary searches	yes	yes
Piloting of the study selection process	yes	no
Formal screening of search results against eligibility criteria	no	no
Data extraction	no	no
Risk of bias (quality) selection	no	no
Data analysis	no	no

The design will be communicated together with an evaluation on added value of videoconferencing research of our centre to healthcare professionals that work together in the UMCG Oncology Committee.

The outcomes of the review will be communicated in the UMCG with the groups that use videoconferencing and in the Netherlands at different locations.

Abstract of the results will be presented in relevant seminars.

Furthermore we will publish the findings of this review in a peer reviewed journal.



Appendix 1: Search Strategies

PubMed

("Interprofessional Relations"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR interprofes*[tiab] OR inter-profes*[tiab] OR professional[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR multidisciplin*[tiab] OR multi-disciplin*[tiab] OR team[tiab] OR teams[tiab] OR tumor board*[tiab] OR tumour board*[tiab])

AND

("Telecommunications"[Mesh:NoExp] OR "Telemedicine"[Mesh] OR "Videoconferencing"[Mesh] OR videoconferenc*[tiab] OR video conferen*[tiab] OR teleconferenc*[tiab] OR tele-conferenc*[tiab] OR video record*[tiab] OR video facilit*[tiab] OR web conferen*[tiab] OR teleonco*[tiab] OR tele-onco*[tiab] OR

((online-based[tiab] OR webbased[tiab] OR web-based[tiab] OR computer-based[tiab] OR internet-based[tiab] OR virtual[tiab]) AND (communicat*[tiab] OR conferen*[tiab] OR meeting*[tiab] OR collaborat*[tiab] OR mdt[tiab] OR mdt[tiab]))

AND

("Neoplasms"[Mesh] OR "Cancer Care Facilities"[Mesh] OR "Medical Oncology"[Mesh] OR "Oncologists"[Mesh] OR "cancer" OR "cancers" OR oncolog* OR "tumor" OR "tumors" OR "tumour" OR "tumours" OR palliat* OR cancer[sb])

CINAHL (ebSCO)

((MH "Interprofessional Relations+") OR (MH "Multidisciplinary Care Team+") OR (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*"))

AND

((MH "Telecommunications") OR (MH "Teleconferencing") OR (MH "Videoconferencing+") OR (MH "Wireless Communications") OR (MH "Communications Software+") OR (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*")) OR

((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*))

AND

((MH "Cancer Care Facilities") OR (MH "Neoplasms+") OR (MH "Oncology+") OR (MH "Oncologists") OR cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*))

Embase (via embase.com)

('multidisciplinary team meeting'/exp OR 'interdisciplinary communication'/exp OR 'public relations'/exp OR 'multidisciplinary team'/de OR 'collaborative care team'/exp OR 'interpersonal communication'/de OR (interprofes* OR 'inter-profes*' OR professional OR interdisciplin* OR 'inter-disciplin*' OR multidisciplin* OR 'multi-disciplin*' OR team OR teams OR 'tumor board*' OR 'tumour board*'):ab,ti)

AND

('telecommunication'/de OR 'teleconference'/exp OR 'videoconferencing'/exp OR 'communication software'/exp OR (videoconferenc* OR 'video conferen*' OR teleconferenc* OR 'tele-conferenc*' OR 'video record*' OR 'video facilit*' OR teleoncol* OR 'tele-oncol*'):ab,ti OR

((online OR webbased OR 'web based' OR web OR computer OR internet OR virtual OR tele OR video) NEAR/8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*)):ab,ti)

AND

('neoplasm'/exp OR 'oncology'/exp OR 'oncologist'/exp OR 'cancer center'/exp OR 'oncologist'/exp OR (cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR



palliat*):ab,ti,de)
NOT
'conference abstract'/it

Cochrane Library (ti,ab,kw)

(interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*")
AND
(videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*" OR
((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video)
near (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*))
AND
(cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)



Appendix 2a: In- and exclusion criteria

Eligible criteria phase one		
Selection criteria	Inclusion	Exclusion
Study design	All study designs	Reviews not applicable, only original research
Settings, domain	Videoconferencing for communication in Healthcare, between 2 or more groups (minimal number per groups = 2) of professionals at different sites aimed at collaboration over patient care	Telemedicine, e-Health, Education purposes only
Settings, healthcare professionals - teams		Professional with patient(s) videoconferencing (if not Telemedicine); One professional to one other professional videoconferencing.
Equipment		No videoconferencing used or only communication with telephone or mail
Time Frame	All time spans	
Languages	All (if needed translation will be done)	



umcg

**Appendix 2b: form screening title and abstract****Form selection abstract Scoping Review Videoconferencing (VC)**

(form results will be marked on the abstract on paper and registered in Excel overview)

Try out will be performed on abstract numbers: 1, 11, 21, 31, 41, 51, 61, 71, 81, 91 and 101.

Refworks Number		
Assessor	<input type="checkbox"/> Lidia van Huizen	<input type="checkbox"/> Pieter Dijkstra
Date (of assessing)		
Title (first 3 words)		
Authors (first author)		
Year of publication		
Journal		

When answering questions: Black: if NO, stop; Red: of Yes, stop.

	Questions on in- and exclusion criteria	Yes	No	Not clear
1	Is the paper original research?			
2	Is VC described?			
3	Is the added value of VC described?			
4	Are participants Healthcare professionals?			
5	Does VC take place between 2 or more groups?			
6	Do the groups at each site or location consist of 2 or more participants?			
7	Is collaboration aimed at patient care or cure?			
8	Is telemedicine, e-Health or Education the only purpose of the VC?			
Remark?				



Appendix2c: form screening full text
Part 2, full text, data extraction after abstract selection

<i>General Reviewers</i>	
Name	
Date (of extraction)	

<i>General information on title / abstract (Result presentation as in Table 1)</i>	
Title	
Authors	
Year publication, source	
Country	
Study location and context	
Study population and size / duration of study	

<i>Objective and methods (study design)</i>	
Aims of the study or objective	
Methodology or methods description	
Inclusion and exclusion criteria	
Methodology / data presented or obtainable	
Data collection period	
Sample size	
Equipment used	
Intervention type	

<i>Results, discussion and conclusions</i>	
Participants	
Key findings related review question	
Limitations of the study	
Other comments / remarks	

<i>Type of information</i>	
<i>Outcome characteristics</i>	
Setting of study	
Setting of participants	
Quality of evidence (specify)	
Is the value of VC discussed?	
<i>Structure of VC</i>	
Participants of videoconferencing (VC) EPOC 4: profession, level of training, clinical specialty (specify)	
Additional setting information	
Is the VC prepared?	
Are recommendations mentioned?	
Are changes in decisions due to the VC registered?	



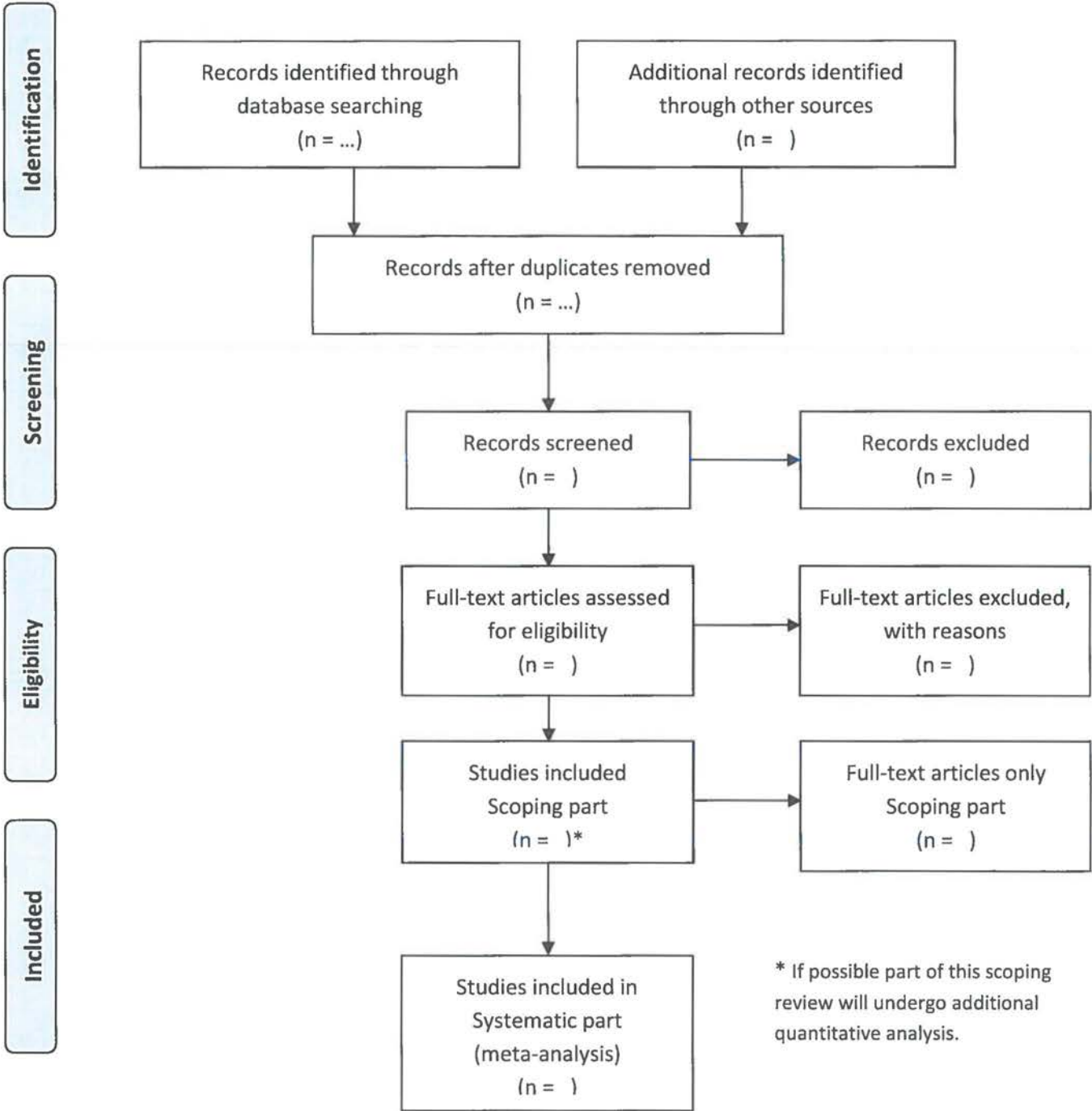
umcG



Is incident or complication discussion part of the agenda?	
<i>Outcome characteristics</i>	
If patients involved specify	
Purpose of videoconference	
Factors for successful videoconference	
Team collaboration	
Formal agreement	
Performance measurement?	
Criteria added value?	
Can participants see each other during interchange of patient information	
Other means of communications for participants besides videoconferencing in the same group?	
Results reported	
<i>Equipment</i>	
Equipment used	
How many screens or computer monitors are available?	
Is it possible to show registrations in the medical records	



Appendix 3: PRISMA-ScR Flow Diagram Videoconferencing²



² From: 2017 Guidance for the Conduct of JBI Scoping Reviews, September 2017; In book: Joanna Briggs Institute Reviewer's Manual, Chapter: 11; Publisher: The Joanna Briggs Institute, Editors: Edoardo Aromataris, Zachary Munn; Project: [Guidance for the Conduct and Reporting of Scoping Reviews](#).

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Supplement 2: Search strategies

MEDLINE (PubMed)

("Interprofessional Relations"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR interprofes*[tiab] OR inter-profes*[tiab] OR professional[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR multidisciplin*[tiab] OR multi-disciplin*[tiab] OR team[tiab] OR teams[tiab] OR tumor board*[tiab] OR tumour board*[tiab])

AND

("Telecommunications"[Mesh:NoExp] OR "Telemedicine"[Mesh] OR "Videoconferencing"[Mesh] OR videoconferenc*[tiab] OR video conferen*[tiab] OR teleconferenc*[tiab] OR tele-conferenc*[tiab] OR video record*[tiab] OR video facilit*[tiab] OR web conferen*[tiab] OR teleonco*[tiab] OR tele-onco*[tiab] OR ((online-based[tiab] OR webbased[tiab] OR web-based[tiab] OR computer-based[tiab] OR internet-based[tiab] OR virtual[tiab]) AND (communicat*[tiab] OR conferen*[tiab] OR meeting*[tiab] OR collaborat*[tiab] OR mdt[tiab] OR mdts[tiab])))

AND

("Neoplasms"[Mesh] OR "Cancer Care Facilities"[Mesh] OR "Medical Oncology"[Mesh] OR "Oncologists"[Mesh] OR "cancer" OR "cancers" OR oncolog* OR "tumor" OR "tumors" OR "tumour" OR "tumours" OR palliat* OR cancer[sb])

CINAHL (EBSCO)

((MH "Interprofessional Relations+") OR (MH "Multidisciplinary Care Team+") OR TI (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*") OR AB (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*"))

AND

((MH "Telecommunications") OR (MH "Teleconferencing") OR (MH "Videoconferencing+") OR (MH "Wireless Communications") OR (MH "Communications Software+") OR TI (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*") OR TI ((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)) OR AB (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR

“tele-oncol*”) OR AB ((online OR webbased OR “web based” OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*))

AND

((MH "Cancer Care Facilities") OR (MH "Neoplasms+") OR (MH "Oncology+") OR (MH "Oncologists") OR cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)

Embase (embase.com)

('multidisciplinary team meeting'/exp OR 'interdisciplinary communication'/exp OR 'public relations'/exp OR 'multidisciplinary team'/de OR 'collaborative care team'/exp OR 'interpersonal communication'/de OR (interprofes* OR 'inter-profes*' OR professional OR interdisciplin* OR 'inter-disciplin*' OR multidisciplin* OR 'multi-disciplin*' OR team OR teams OR 'tumor board*' OR 'tumour board*'):ab,ti)

AND

('telecommunication'/de OR 'teleconference'/exp OR 'videoconferencing'/exp OR 'communication software'/exp OR (videoconferenc* OR 'video conferen*' OR teleconferenc* OR 'tele-conferenc*' OR 'video record*' OR 'video facilit*' OR teleoncol* OR 'tele-oncol*'):ab,ti OR ((online OR webbased OR 'web based' OR web OR computer OR internet OR virtual OR tele OR video) NEAR/8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdt*)):ab,ti)

AND

('neoplasm'/exp OR 'oncology'/exp OR 'oncologist'/exp OR 'cancer center'/exp OR 'oncologist'/exp OR (cancer* OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*):ab,ti,de)

NOT

'conference abstract'/it

Cochrane Library (Cochrane reviews + Trials)

(interprofes* OR “inter-profes*” OR professional OR interdisciplin* OR “inter-disciplin*” OR multidisciplin* OR “multi-disciplin*” OR team OR teams OR “tumor board*” OR “tumour board*”)

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based” OR web OR computer OR internet OR virtual OR tele OR video) near (communicat* OR
conferen* OR meeting* OR collaborat* OR mdt OR mds)))

AND

(cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour*
OR palliat*)

For peer review only

Supplement 3: Characteristics of excluded studies

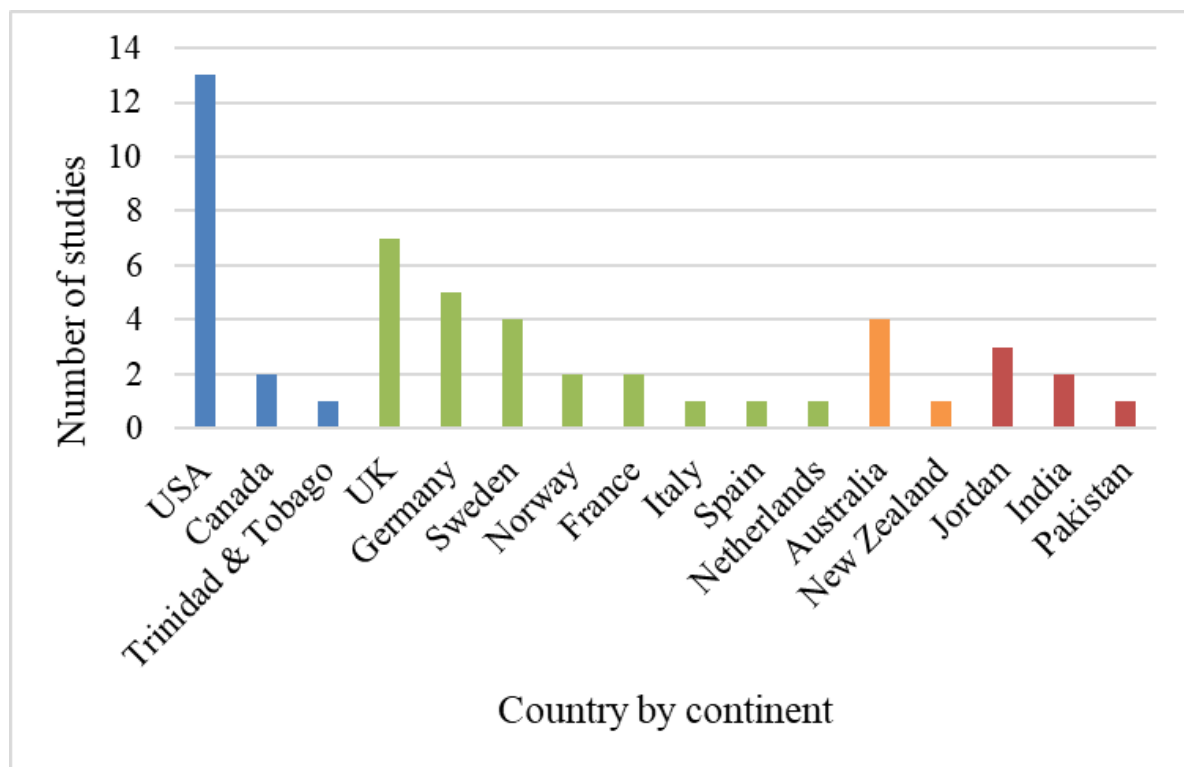
<i>Authors</i>	<i>Year</i>	<i>World part, country</i>	<i>Reason for exclusion</i>
Burgess et al.	1999	USA	Videoconferencing specialist with patients
Atlas et al.	2000	Israel-USA	No structured evaluation of videoconferencing
Larcher et al.	2002	Italy	No videoconferencing
Mitchell et al.	2002	Australia	No cancer
Barry et al.	2003	UK	Answers to question 5 and 7 stays unclear
Gagliardi et al.	2003	Canada	Research only
Mitchell et al.	2005	Australia	No cancer
Pradeep et al.	2006	India	No structured evaluation of videoconferencing
Gagliardi et al.	2007	Canada	No videoconferencing
Lehoux et al.	2007	Canada	No cancer
Ashton et al.	2008	UK	Review
Ferrer et al.	2008	France	No videoconferencing
Mitchell et al.	2008	Australia	No videoconferencing
Qaddoumi et al.	2008	Jordan	No videoconferencing
Lewis et al.	2009	UK	Answers to question 5 and 7 stays unclear
Underhill et al.	2010	Australia	Education only
Vezzoni et al.	2011	Italy	Not primarily aimed at cancer treatment
Burns et al.	2012	Australia	Videoconferencing specialist with patients
Fitzpatrick et al.	2012	Canada	No videoconferencing
Washington et al.	2012	USA	Not primarily aimed at cancer treatment
Xilinas et al.	2012	USA	No videoconferencing
Langfeldt et al.	2013	Norway	No structured evaluation of videoconferencing
Chalabreysse et al.	2014	France	Videoconferencing specialist with patients
Francescutti et al.	2014	Canada	No videoconferencing
Holden et al.	2014	USA	Editorial
Berlanga et al.	2015	Spain	No videoconferencing
Gruttadauria et al.	2015	Italy	No cancer
Hue et al.	2015	France	No videoconferencing
Washington et al.	2015	USA	Not primarily aimed at cancer treatment
Garica Adrian et al.	2016	Spain	No cancer
Horton et al.	2016	USA	Abstract only
Wey Pang et al.	2016	UK	Abstract only
van Gurp et al.	2016	Netherlands	Videoconferencing specialist with patients
Pang et al.	2016	UK	Abstract only
Mascarenhas et al.	2017	Portugal – Netherlands	No structured evaluation of videoconferencing
Qaddoumi et al.	2017	Brazil	No videoconferencing
Cobb et al.	2018	UK	Abstract only
Ribelles et al.	2018	Australia	No structured evaluation of videoconferencing
Scott et al.	2018	USA	No structured evaluation of videoconferencing
Yu et al.	2018	China	No videoconferencing
Moss et al.	2019	UK	No videoconferencing
Nemecek et al.	2019	Austria	Videoconferencing specialist with patients
Terry et al.	2019	USA	Videoconferencing specialist with patients
Funderskov et al.	2019	Denmark	Videoconferencing specialist with patients
Jung et al.	2019	Australia	No videoconferencing
Abbasi et al.	2020	Pakistan	Editorial
Ambrosini et al.	2020	Italy	Videoconferencing specialist with patients
Anderson et al.	2020	Australia	Videoconferencing specialist with patients
Arlt et al.	2020	UK-Netherlands	Videoconferencing specialist with patients
Arrese et al.	2020	Chile	Editorial
Aseem et al.	2020	UK	Editorial
Dhamarajan et al.	2020	USA	No structured evaluation of videoconferencing
Doolittle et al.	2020	USA	No cancer
Elkaddoum et al.	2020	Lebanon	Editorial
Garcia Adrian et al.	2020	Spain	Abstract only

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<i>Authors</i>	<i>Year</i>	<i>World part, country</i>	<i>Reason for exclusion</i>
Hellingman et al.	2020	Netherlands	No videoconferencing
Henderson et al.	2020	USA	No structured evaluation of videoconferencing
Kedia et al.	2020	USA	No videoconferencing
Perri et al.	2020	Canada	No cancer
Podda et al.	2020	Italy	No videoconferencing
Rajasekaran et al.	2020	UK	No structured evaluation of videoconferencing
Rangabashyam et al.	2020	Singapore	No videoconferencing
Rao et al.	2020	USA	No videoconferencing
Salari et al.	2020	Iran	Editorial
Triesman et al.	2020	USA	No structured evaluation of videoconferencing
Wiggins et al.	2020	UK	No structured evaluation of videoconferencing

For peer review only

Supplement 4: Number of studies by continent and country



Legenda

This figure shows the number of studies by continent and by country where the teams were based that are described in the 50 studies included in the analysis.

Blue = North America (16 studies); Green = Europe (23 studies); Orange = Oceania (5 studies); Red = Asia (6 studies).

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Supplement 5: Descriptives regarding videoconferencing use

For a detailed description of the six types of VC collaboration see Table 1.

For the convenience of the reader the legend of the table is provided above and below this table.

Legend

Abbreviations: CNS = Central Nervous System; ds = days; chemo = chemotherapy; ChemoRT = Chemoradiotherapy; CT = Computer Tomography; FtF = face-to-face, physically; GBI = Group Behaviour Inventory; GI = Gastro-Intestinal; GP = General Practitioner; HPB = Hepatobiliary; h = hour; ISDN = Internet Service Digital Network; MD = Medical Doctor; MDTM = Multidisciplinary Team Meeting; min. = minutes; PET = Positron Emission Tomography; POS = Palliative care Outcome Scale; QoL = Quality of Life; RCT = Randomized Controlled Trial; RT = Radiotherapy; SV = Survey; VC = Videoconferenced-MDTM.

Patient: information related to patients; HP: information related to healthcare professionals; Survey: information related to surveys; Interv.: information related to interviews.

We recorded VC for diverse wording in the studies: tumour board by VC or multidisciplinary team by VC or collaborative care team by VC or International Tumour Board by VC; Multidisciplinary Cancer Conferences by VC.

We used the term cases when a patient’s case was presented or discussed in a VC or FtF meeting; one patient might be discussed multiple times in successive MDTMs.

Explanation of coding of frequency: Freq. = frequency of MDTM; W = Weekly, 2W or 3W = twice or trice per week, M = Monthly, 2M is twice per month, D = Daily, Bw = Bi-weekly.

Explanation of coding of treatment: At = Adult treatment, Pc = Palliative care, Pt = Paediatric treatment.

Additional information: * study period from main text, ** referred paper with details on study, *** corresponding author; ▼ = exchange rate 1999: for 1 USD you get 0.94 Euro; ▲ = exchange rate 2012: for 1 USD you get 0.78 Euro; ◀ = exchange rate 2002: for 1 British Pound you get 1.6 Euro; ▶ exchange rate 1999: for 1 SEK you get 0.116 Euro.

If authors had not clearly stated the aim of the study, the research method or the data sources, the text in *italics* is the interpretation of the authors of this review.

For the description of the aim of the study we used the word ‘describe’ if the paper described, reported or showed the result; we used the word ‘evaluate’ if the study evaluated, analysed or assessed outcomes. We used ‘review of case records’ if the paper did not clearly state research method and the data source. If we could not retrieve the information in the results, we recorded ‘Not reported’.

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treat- ment type	Evaluation period
1. Expert MDTM-National								
Axford et al. (2002)	United Kingdom (UK)	<i>Describe</i> VC	Review of audit form on cost, attendance and technical features	<u>Patient</u> : mean 4.8 cases in 42 VCs <u>HP</u> : mean 15 staff of which 8 participants in 42 VCs	W	Breast, lung, colorectal, esophageal, gastric	At	Nov 2000 to Oct 2001
Billingsley et al. (2002)	USA	Describe VC	Review of case records	<u>Patient</u> : 85 cases; 38% referred to cancer centre; improved access to multidisciplinary care <u>HP</u> : improved referral coordination	Bw	Head-and-neck, lung, colon, leukaemia, other	At, Pc	2000-2001

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Bumm et al. (2002)	Germany	Describe VC	<i>Review of databases</i>	<u>Patient</u> : 3298 cases (2438 patients); 1 case in 5 min. <u>HP</u> : duration VC 30-35 min.	D	Esophagus, stomach, pancreas, colon, liver, rectum	At	Oct 1999 to Feb 2002
Delling et al. (2002)	Germany	Describe VC	<i>Review of databases</i>	<u>Patient</u> : 121 cases; 27 cases had frozen section pathology of which in 24 the concept diagnosis was correct <u>HP</u> : improved safety of diagnostic process; training for less experienced colleagues	W	Bone	At	Aug 2001 to May 2002*
Niemeyer et al. (2003)	Germany	Describe VC	<i>Review of databases</i>	<u>Patient</u> : 190 cases; 51 cases had frozen section pathology: 39 diagnostic and 12 during surgery, in which 11 showed tumour free surfaces <u>HP</u> : duration VC 45 min.	W	Bone	At	Aug 2001 to Feb 2003*
Bauman et al. (2005)	Canada	Feasibility of VC for regional participation	Survey among participants	<u>Patient</u> : mean 5 cases in 6 VCs <u>HP</u> : 1 case in 20 min.; in 60% of cases recommendations for change were made; clinical research associates attended VC to recruit for clinical trials (40% eligible) <u>Survey</u> : 17 of 21 SVs returned	M	Prostate, bladder, renal, testicular	At	Jan 2003 to June 2003
Norum et al. (2006)	Norway	Feasibility of VC and e-mail	<i>Review of case records</i>	<u>Patient</u> : 5 cases <u>HP</u> : 78% educational VC, costs were lower at > 12 VCs per y; 84% of 32 planned VCs succeeded	W	Breast, colorectal	Pc	Nov 2002 to Nov 2003
Dickson-Witmer et al. (2008)	USA	Describe VC	<i>Review of case records</i>	<u>Patient</u> : PET-scan 14-21 ds reduced to 7 d, CT 7 ds to 1 ds <u>HP</u> : 6-8 cases discussed with 40 HPs in 1 h; compliance to treatment standards was in 2004 92% and in 2006 to 95% for recommendations given; clinical trial accrual increased from 9.9% in 2001 to 20% in 2006	W	CNS, breast, chest, gynaecological, genitourinary, lymphoma	At	2006

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treat-ment type	Evaluation period
Salami et al. (2015)	USA	Evaluate VC	Review of databases	<u>Patient</u> : 116 cases, of which 41% in VC; in VC more were ≥ 65 years (29%), had higher degree of comorbidity (79%) and had portal hypertension (49%) compared to cases in FtF (15%, 44%, and 28%) <u>HP</u> : waiting time to diagnosis VC (median 26 d) vs FtF (median 63 d); in VC multidisciplinary (92%) and guideline driven evaluations (100%) vs FtF (65% and 75%)	W	HPB	At	2009 to 2013
Thillai et al. (2016)	UK	Evaluate VC for early referral	Review of databases	<u>Patient</u> : 159 cases; 42% referred at initial diagnosis <u>HP</u> : in 22 of 53 not referred cases, imaging was not available for evaluation	2W	Colorectal with liver metastases	At	2012, 6 months
Wilson et al. (2016)	Australia	Feasibility VC	Review of case records	<u>Patient</u> : mean 8.7 cases in 18 VCs (2010) vs mean 8.0 cases in 25 VCs (2011) <u>HP</u> : 28% increase in cases in 2011 due to improved administrative support; waiting time to case discussion in MDTM from referral (standard 14 d) mean 28% to 42%	Bw	Upper GI	At, Pc	Jan 2010 to Dec 2011
Powell et al. (2018)	USA	Feasibility VC for molecular profiling	Prospective cohort Molecular Profiles Tumour response and patient survival	<u>Patient</u> : 109 of 120 cases profiled; 16% of patients declined recommended treatment and preferred palliative care in a hospice, because they were too ill; tumour response and survival (n=16) in genome clinical trials were similar to that (n=16) receiving Food and Drug Administration off-label treatment <u>HP</u> : 58% of patients heard recommendations on their treatment plan from their treating physician in the community setting	2W	Advanced solid tumours	At	June 2014 to Dec 2015

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Rosell et al. (2019)	Sweden	Evaluate VC	Survey among participants Observation of behaviour	<u>Patient</u> : - <u>HP</u> : meeting observational tool assesses functionality and participants' contribution to the case discussion: high scores for case histories, leadership, and teamwork; lower scores for patient-centred care and involvement of care professionals for national VC MDTM <u>Survey</u> : 125 of 241 SVs returned of which 87% MDs (56% surgery, 26% medical oncology, paediatric oncology 10%, radiology 6% and pathology 2%), 11% nurse, medical secretaries 2%	W	Esophageal, HPB, anal, vulvar, penile, childhood cancer	At, Pt	May 2017 to May 2018
Brandl et al. 2020	UK – Ireland	Evaluate VC	Data base review Follow-up for survival information	<u>Patient</u> : mean 4.6 new cases in 34 VCs; 35 patients were discussed more than once; 19 of 22 had complete cytoreduction of cancer cells after surgery <u>HP</u> : effective selection for specialised, expensive treatment (87% diagnosis confirmed)	M	Peritoneal mesothelioma (GI)	At	Mar 2016 to Dec 2018
Fitzgerald et al. (2020)	Australia - New Zealand	Feasibility VC for review of stereotactic chart use	Review of case records	<u>Patient</u> : 285 cases of which 237 were new <u>HP</u> : 1126 attendances in 12 months from 114 participants of 21 locations including 27 radiotherapists from 13 locations; mean 1.2 recommendations per patient; inverse relationship between VC case load and recommendations ($p < 0.002$)	W	CNS, lung, liver, bone, spine	At	July 2018 to July 2019
Pan et al. (2020)	USA	Feasibility VC	Review of case records Survey among referring physicians	<u>Patient</u> : 1585 cases: 60 in 2013 increased to 364 in 2019 <u>HP</u> : implementation of recommendations increased from 18% in 2016 to 48% in 2019 as indicated by respondents; 50% of cases had pathology assessment in 2016, upon extra hire it increased to 95% in 2019 <u>Survey</u> : 6 months (2013): 6 SVs returned; 3 y (2015): 32 SVs returned; 6 y (2019): 54 SVs returned	M - Bw - W	Sarcoma	At	2013 to 2019

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treat-ment type	Evaluation period
Rosell et al. (2020)	Sweden	Evaluate VC	Survey among participants	<u>Patient</u> : - <u>HP</u> : national level and regional level MDTM is valuable in sharing knowledge for treatment of specialty tumours and complex cases <u>Survey</u> : 125 of 241 SVs returned of which 87% MDs (53% surgery, 26% medical oncology, radiology 6%, pathology 2% and ‘none of the name’ 14%), 11% nurse	W	Esophageal, HPB, anal, vulvar, penile, childhood cancer	At, Pt	May 2017 to May 2018
2. Expert MDTM-International								
Bharadwaj et al. (2007)	USA – India	Evaluate VC	<i>Review of case records</i>	<u>Patient</u> : 26 cases; 50% had severe pain; 10% was hospitalized; mean care 40 d <u>HP</u> : duration VC 60 – 90 min.; 81 e-mails for follow-up, treatment strategies, doubts and clarifications; 4 text messages for urgent consultation; 11 cases presented in ‘Subjective-Objective-Assessment-Plan’-format	3W	77% cancer, <i>not specified</i>	Pc	2006***, 2 months
Qaddoumi et al. (2007)	Jordan – Canada	Feasibility of VC	<i>Review of case records</i>	<u>Patient</u> : mean 3.6 cases in 20 VC; in 23 cases recommendations on treatment plans were significant changes, which were followed in 21; increased survival <u>HP</u> : max. 6 cases per VC; optimal duration of collaboration is unclear	M	CNS	Pt	Dec 2004 to Apr 2006
Qaddoumi et al. (2008)	Jordan – Canada	Evaluate VC	<i>Review of case records</i>	<u>Patient</u> : mean 3.9 cases in 26 VC <u>HP</u> : review of radiation fields in interactive discussion through VC led to better surgery and RT practice	M	CNS	Pt	Dec 2002 to Dec 2006
Amayiri et al. (2018)	Jordan – Canada	Evaluate VC sustainability	Review meeting minutes	<u>Patient</u> : mean 3.6 cases in 20 VCs, 2004-2006; mean 4.9 cases in 33 VCs, 2007-2009; mean 3.8 cases in 32 VCs, 2011-2014; 16 suggestions for molecular testing, 2011-2014 were followed in 6 cases <u>HP</u> : recommendations given in 44% to 30% to 24% of cases; costs VC from 280 to 30 Euro ▲/ h	M	CNS	Pt	Dec 2004 to Apr 2006 vs Jan 2007 to Dec 2009 vs Aug 2011 to Apr 2014

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Mayadevi et al. (2018)	India – USA	Feasibility of VC for dysphagia	Review of case records	<u>Patient</u> : mean 1.4 cases in 18 VCs; Functional Oral Intake Scale improved from 1.46 ± 0.989 to 3.92 ± 1.809 ($p < 0.0001$) <u>HP</u> : recommendations were followed in 22 of 26 patients, neuromuscular electrical stimulation was too costly or logistically impossible	M	Head-and-neck	At	18 months
3. Expert Consultation								
Sezeur et al. (2001)	France	Evaluate VC for transfer of patients	Review of case records Survey among patients	<u>Patient</u> : mean 3.2 cases in 27 VCs; 48 case discussions and 39 second opinions; in 2 of 48 cases treatment plans were changed; patients remembered 80.5% of information given after 24 h <u>HP</u> : saved € 77.85 per patient on transport by ambulance; low speed of connection gave less diagnostic image quality <u>Survey</u> : 16 of 16 SVs returned on VC; 12 of 16 SVs returned on memorization	2W	Gastric	At	Nov 1996 to Mar 1998**
Stalfors et al. (2005)	Sweden	Evaluate costs of FtF vs VC	Health economic analysis Survey among patients	<u>Patient</u> : 50 cases FtF, 68 cases VC <u>HP</u> : cost VC € 236 vs FtF € 263; MDs accompanied patients in 100% of VC-sessions vs 15% of FtF <u>Survey</u> : 39 of 50 FtF vs 45 of 68 VC patient SVs returned	W	Head-and-neck	At	Sept 1998 to Sept 1999
Chekerov et al. (2008)	Germany	Feasibility of VC	Review of case records Survey among participants	<u>Patient</u> : mean 4 cases (range 2-7) in 39 VCs; 144 cases and 121 second opinions <u>HP</u> : mean 17 participants in 39 VCs, who attended median 6 VCs; 98% recommendations were accepted <u>Survey</u> : 43 of 75 SVs returned first; 51 of 75 SVs returned	Bw	Gynaecological	At	Dec 2004 to Aug 2006
Schroeder et al. (2011)	Germany	Evaluate VC	Survey among participants	<u>Patient</u> : mean 3.5 cases (range 1-7) in 131 VCs; 398 second opinions; no hospital visit for second opinion <u>HP</u> : median 14 participants in 131 VCs; 50% VC-participants asked more second opinions <u>Survey</u> : 205 of 275 SVs returned	Bw	Breast, gynaecological	At	Dec 2004 to June 2009

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treat-ment type	Evaluation period
Seeber et al. (2013)	Italy – Austria	Feasibility of VC	<i>Review of case records (historical vs VC)</i>	<u>Patient</u> : 93 historical, 110 VC; mean 1 case in 104 VCs <u>HP</u> : 8 minor and 20 major treatment plan changes (25%); access to cancer-centre-specific treatment modalities 63 RT treatments in VC vs 34 historical	Bw	Lung	At	May 2003 to Aug 2007 Aug 2007 to May 2011
Stevenson et al. (2013)	USA	<i>Describe VC</i>	Review of case records Survey among participants	<u>Patient</u> : mean 1.7 cases in 10 VCs (2011), 22 cases in 13 VCs (2012) <u>HP</u> : mean 10 participants per VC; 1 case in 30 min.; reduction overall costs of MDTM by VC in rural community <u>Survey</u> : 10 of 20 SVs returned	Bw	Lung	At	2009-2013
Crispen et al. (2014)	Bahamas, Trinidad and Tobago	Evaluate VC for peer review in radiotherapy	Review of case records Survey among participants	<u>Patient</u> : 40 cases, 10 from each tumour type <u>HP</u> : Radiotherapists were satisfied with audio-visual aspects of VC; RT standard has no security or confidentiality guide for VC <u>Survey</u> : 10 of 10 SVs returned	W	Head-and-neck, breast, cervical, prostate	At	July to Nov 2013
Shea et al. (2014)	USA	Feasibility of VC	Survey among participants Interviews among participating specialists Observations of VC	<u>Patient</u> : 15 cases from 6 counties; <u>HP</u> : 14 VCs observed; VC is an opportunity for clinical trial recruitment; valuable discussion of complex cases <u>Survey</u> : 32 of 32 SVs returned <u>Interv.</u> : 28, 16 centre vs 12 community-based	Bw	All	At	Aug 2011 to March 2012
Frappaz et al. (2016)	France	Describe VC national expert consultation	<i>Review of case records</i>	<u>Patient</u> : mean 3.7 cases in 46 VCs; 48% primary tumours <u>HP</u> : VC is an opportunity for clinical trial recruitment; valuable discussion of complex cases	W	CNS	Pt	2015

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Burkard et al. (2017)	USA	Evaluate VC Precision Medicine Molecular Tumour Board	Review of databases	<u>Patient</u> : mean 3.2 case in 23 VCs; 48 cases in registry of which 38 had recommendations and clinical follow-up <u>HP</u> : max. 6 cases in 1 h; mean time referral to presentation 13.5 d; access to clinical trials which aim to find new biomarkers (18 genes); 1 of 14 patients enrolled in clinical trials in the state due to advanced illness, no outside-state trial enrolment	Bw	Breast, gastric, lung	At	Sept 2015 to Sept 2016
Abu Arja et al. (2018)	USA, Latin American countries	Evaluate Latin American VC	Survey among participants	<u>Patient</u> : - <u>HP</u> : 1 h sufficient to discuss requested cases from 20 countries; 39% attendees said sending pathology slides to USA was easy and helpful <u>Survey</u> : 95 of 159 SVs returned (66 frequent attendance, 23 not-frequent, 11 never attended)	W	CNS	Pt	Dec 2017 to Mar 2018***
4. Consultation Specialist - Nurse								
Saysell et al. (2003)	UK	Evaluate VC	Survey among participants Focus groups	<u>Patient</u> : mean 0.9 cases in 29 VCs; 96% cancer <u>HP</u> : mean 5 attendees in 29 VCs; 12 additional monthly educational VCs; 19 symptom control issues discussed <u>Survey</u> : 25 of 26 SVs returned	W	Breast, lung, bladder, prostate, gastric, ovarian	Pc	Oct 2001 to Oct 2005
O'Mahony et al. (2009)	USA	Evaluate VC for Bioethics and QoL	Pre- and post-education test for staff Survey among patients and staff with Palliative Care Outcome Scale (POS)	<u>Patient</u> : enhanced end-of-life care through better knowledge of nursing staff <u>HP</u> : mean 5.5 staff with 1 family member in 13 VCs vs mean 5.8 staff with 0.9 family member in 14 FtFs; up-to 90 min. preparations time in an off-unit conference room; 1 VC rescheduled due to internet problems <u>Survey</u> : 75 POS SVs returned: 33 staff, 23 family caregivers, 19 patients	2M	<i>Not specified</i>	Pc	Mar 2008 to Jan 2009

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treat-ment type	Evaluation period
Donnem et al. (2012)	Norway	Feasibility of VC	Review of case records Survey among participants	<u>Patient</u> : mean 1.6 cases in 106 VCs; 75% palliative; 82% stayed in community for symptom management (pain management and nutrition) after VC introduction vs 70% before VC <u>HP</u> : median 7 participants in 106 VCs; waiting time for consultation with oncologist at centre reduced with 8 ds to max. 7 ds <u>Survey</u> : 141 of 167 SVs returned	W	Breast, colorectal	At, Pc	Mar 2009 to Sept 2010
Watanabe et al. (2012)	Canada	Feasibility of VC for palliative RT consultation	Prospective case series Survey among participants and patients	<u>Patient</u> : 44 new cases from 29 communities with 28 follow-up visits; 7.96 h saved time, € 149.93▲ saved expense per visit <u>HP</u> : 1 new case in 90 min. and 1 follow-up visit in 30 min. in 1 VC; 1 visit completed by telephone due to technical difficulties <u>Survey</u> : 19 of 44 GP SVs returned; 44 of 44 patient SVs returned	W	All	Pc	Jan 2008 tot Mar 2011
5. MDT-Equal								
Delaney et al. (2004)	Australia	Evaluate FtF vs VC	Anthropological analysis of interpersonal interactions Pre- and post-survey among participants	<u>Patient</u> : median 4 cases per VC vs 6 FtF; <u>HP</u> : median 10 participants VC vs 8 FtF; more formal behaviour (less joking) <u>Survey</u> : pre 16 of 27 vs post 16 of 26 SVs returned	W	Breast	At	Feb to July 2000
Savage et al. (2007)	UK	Evaluate VC	<i>Review of case records</i> Survey among participants	<u>Patient</u> : 48 new cases with 182 issues; 29 complex cases <u>HP</u> : timing and frequency of VCs was appropriate (92% and 96%) <u>Survey</u> : 50 of 85 SVs returned	M	Head-and-neck	At	Nov 2003 to June 2006

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Marshall et al. (2014)	United States of America (USA)	Feasibility of VC	Review of case records Survey among participants	<u>Patient</u> : access to cancer centre stayed 7.5 d <u>HP</u> : partner brought 14 of 90 cases by VC; 1 case in 13.1 min. VC vs 8.4 min. FtF (p = .004); 12 of 16 MDTMs used VC during part FtF MDTM <u>Survey</u> : 36 of 36 SVs returned	W	Breast, esophageal, gastric, HPB, colorectal, melanoma, sarcoma	At	4 months
Alexandersson et al. (2018)	Sweden	Evaluate VC costs	Observation of VC Survey among participants	<u>Patient</u> : mean 12.7 cases per VC and FtF-session <u>HP</u> : mean duration VC 68 min. vs FtF 46 min.; 14 of 50 MDTMs used VC during part of FtF MDTM <u>Survey</u> : 104 of 105 SVs returned	W	All but hematologic cancers	At	Feb to July 2016
Van Huizen et al. (2019)	Netherlands	Evaluate VC	Review of case records Observation of VC Interviews among participants	<u>Patient</u> : mean 18.6 cases per VC; 336 cases in 18 VCs got 8 recommendations (2%), that were major or minor changes aimed at optimization of treatment outcome <u>HP</u> : complex cases were discussed more than once; during 61% of VCs all key specialists were present <u>Interv.</u> : 6 specialists, 3 at each site	W	Head-and-neck	At	Sept 2016 to Feb 2017
6. MDTM-Collaborate								
Hunter et al. (1999)	USA, Pacific	Describe web-based VC	Survey among participants Assessment of technical features	<u>Patient</u> : 103 cases; 16 evacuations to cancer centre prevented <u>HP</u> : > 84% cases discussed were major contribution to VC session; audio and image quality: 79% and 100% > good; pathology and radiology imaging: 89% and 75% > good; costs centre vs remote partner € 304▼ vs € 511 <u>Survey</u> : 38 of 38 SVs returned	W	All	At	Oct 1996 to Dec 1998
	USA, North Carolina	Describe ISDN VC	Survey among participants Assessment of technical features	<u>Patient</u> : 304 cases <u>HP</u> : > 95% case discussions were major contribution to VC session; audio and image quality: 100% good, pathology and radiology imaging: 95 and 95% > good; costs centre vs remote partners € 250▼ vs € 335 <u>Survey</u> : 22 of 25 SVs returned	W	Breast	At	Feb 1998 to Jan 1999

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treat-ment type	Evaluation period
Olver et al. (2000)	Australia	Evaluate VC	<i>Review of case records</i> Survey among participants and patients	<u>Patient</u> : median 30 cases per y <u>HP</u> : 10 of 17 MDs using VC changed their way of working practice <u>Survey</u> : 20 of 20 participant SVs returned (including 3 nurses); 8 patient SVs returned	W	Breast	At, Pc	1999***, 3 months
Davison et al. (2004)	UK	<i>Describe VC</i>	<i>Review of case records</i>	<u>Patients</u> : 62% (15) cancer cases in 28 VCs; reduced length of stay with 0.67 d <u>HP</u> : range 1-7 cases in 1 VC; surgery access time reduced from 69 ± 38 to 54 ± 26 d; achieved standard treatment within 56 d; increased resection rate from 14.7 to 19.0 per y	W	Lung	At	Nov 2000 to Oct 2001
Kunkler et al. (2006)	UK	Evaluate FtF vs VC	Survey among participants before and in week 28 of the RCT	<u>Patient</u> : - <u>HP</u> : GBI showed positive scores for both FtF and VC, e.g. on decision making and efficiency; minor difference for FtF e.g. less physical resources <u>Survey</u> : 33 of 44 FtF returned (pre VC); 24 of 32 VC (post VC); 11 pre- / post VC returned of same participant	W	Breast	At	Mar 2004 to Apr 2005
Kunkler et al. (2007)	UK	Evaluate FtF vs VC	Participant satisfaction on case discussions Economic evaluation	<u>Patient</u> : median 7 cases in FtF vs 5 in VC; 195 cases in FtF vs 278 VC <u>HP</u> : 28 FtF- and 48 VC-sessions; same confidence level treatment plan decisions; costs were lower at > 40 VCs per y	W	Breast	At	Mar 2004 to Apr 2005
Stevens et al. (2012)	New Zealand	Evaluate FtF vs VC	Review of meeting minutes	<u>Patient</u> : 35% RT-cases VC vs 29% RT-cases FtF <u>HP</u> : no sign. differences FtF vs VC in waiting time from diagnosis to start RT and on % recommended RT vs treatment performed	W	Lung	At	Jan to June 2009
Murad et al. (2014)	Pakistan	Evaluate VC	<i>Review of case records</i>	<u>Patient</u> : mean 3.7 cases, mean 13 min. per case; drop-outs for chemotherapy after surgery reduced from 36% to 19% <u>HP</u> : 31% minor changes, 12% major changes; departmental database was started for management evaluation purposes	W	Breast, gastric, endocrine, skin, soft tissue	At	Nov 2009 to Dec 2011

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Novoa et al. (2016)	Spain	Evaluate occasional vs regular weekly VC	<i>Review of databases</i>	<u>Patient</u> : 563 cases occasional vs 464 cases weekly VC <u>HP</u> : ratio 0.70 thoracic surgery cases / new cases seen in occasional VC went up to 0.87 in weekly VC	W	Lung	At	2008-2010 vs 2011-2013

Legend

Abbreviations: CNS = Central Nervous System; ds = days; chemo = chemotherapy; ChemoRT = Chemoradiotherapy; CT = Computer Tomography; FtF = face-to-face, physically; GBI = Group Behaviour Inventory; GI = Gastro-Intestinal; GP = General Practitioner; HPB = Hepatobiliary; h = hour; ISDN = Internet Service Digital Network; MD = Medical Doctor; MDTM = Multidisciplinary Team Meeting; min. = minutes; PET = Positron Emission Tomography; POS = Palliative care Outcome Scale; QoL = Quality of Life; RCT = Randomized Controlled Trial; RT = Radiotherapy; SV = Survey; VC = Videoconferenced-MDTM.

Patient: information related to patients; HP: information related to healthcare professionals; Survey: information related to surveys; Interv.: information related to interviews. We recorded VC for diverse wording in the studies: tumour board by VC or multidisciplinary team by VC or collaborative care team by VC or International Tumour Board by VC; Multidisciplinary Cancer Conferences by VC.

We used the term cases when a patient's case was presented or discussed in a VC or FtF meeting; one patient might be discussed multiple times in successive MDTMs.

Explanation of coding of frequency: Freq. = frequency of MDTM; W = Weekly, 2W or 3W = twice or thrice per week, M = Monthly, 2M is twice per month, D = Daily, Bw = Bi-weekly.

Explanation of coding of treatment: At = Adult treatment, Pc = Palliative care, Pt = Paediatric treatment.

Additional information: * study period from main text, ** referred paper with details on study, *** corresponding author; ▼ = exchange rate 1999: for 1 USD you get 0.94 Euro; ▲ = exchange rate 2012: for 1 USD you get 0.78 Euro; ◀ = exchange rate 2002: for 1 British Pound you get 1.6 Euro; ▶ exchange rate 1999: for 1 SEK you get 0.116 Euro.

If authors had not clearly stated the aim of the study, the research method or the data sources, the text in *italics* is the interpretation of the authors of this review.

For the description of the aim of the study we used the word '*describe*' if the paper described, reported or showed the result; we used the word '*evaluate*' if the study evaluated, analysed or assessed outcomes. We used '*review of case records*' if the paper did not clearly state research method and the data source. If we could not retrieve the information in the results, we recorded '*Not reported*'.

Supplement 6: Benefits, drawbacks, VC team participants and VC platform used in MDT-Equal and MDTM-Collaborate videoconferencing

Legend
Abbreviations: ENT = Ear-Nose-Throat; FtF = face-to-face, physically; HC = Healthcare professional; MD = Medical Doctor; MDT = Multidisciplinary Team, MDTM = Multidisciplinary Team Meeting; MF = Maxillofacial; pub = publication; RT = Radiotherapy; VC = Videoconferenced-MDTM; * from corresponding author.
VC team participants: MDt: Medical Doctors in therapeutic disciplines: surgeons, (medical) oncologists and radiotherapists; MDd: Medical Doctors in diagnostic disciplines: radiologist, pathologist, nuclear medicine physician; Sd: supportive disciplines related to treatment and palliative care: nurses, dieticians, etc; Other: staff, medical secretaries and medical administration; see supplement 7.
PC Platform abbreviations: CCD = charge-coupled device camera; DICOM = Digital Imaging and Communications in Medicine; DSL = Digital Subscriber Line; EMR = Electronic Medical Record; HW = hardware; ISDN = Integrated Service Digital Network; M / Kbps = Mega / Kilobits per second; PACS = picture archiving & communication system; PC = personal computer; SW = software; TCP / IP = Transmission Control Protocol / Internet Protocol.
** Kunkler's studies used the same VC-Platform; *** Novoa described two MDTMs that use the same VC-Platform.
If authors had not clearly stated the data sources, the text in *italics* is the interpretation made by the authors of this review. Where we could not retrieve information, we put '*Not reported*'.

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
MDT-Equal					
Delaney et al. (2004)	<u>Patient</u> : Improved access to multidisciplinary care <u>HC</u> : improved access to multidisciplinary discussions; U-shaped table improved interaction between participants because they then face each other	<u>HC</u> : More formalised and regimented professional relationships of MDs; 1 of the 2 district hospitals did not want to continue because of time constraints	Liverpool Hospital, Sydney*: <u>MDt</u> : oncologist, radiotherapist; <u>MDd</u> : pathologist, radiologist; <u>Other</u> : medical students	2 general district hospitals*: <u>MDt</u> : surgeon, oncologist, radiotherapist	HW: PictureTel Swiftsite-2, PictureTel Venue 2000 and PictureTel Concord 4500 SW: bridge support; bandwidth 384 Kbps Room: U-shaped table
Savage et al. (2007)	<u>Patient</u> : recommendations concerning major or minor changes to treatment plans for complex cases <u>HC</u> : less travel for specialists; served as an educational tool	<u>Patient</u> : less suitable for recruitment for clinical trials and research discussions <u>HC</u> : less suitable for research discussions	Centre, Glasgow*: <u>MDt</u> : ENT-, MF-surgeons, oncologists; <u>MDd</u> : radiologists, pathologists; <u>Sd</u> : specialist nurses, dieticians, speech and language therapists; <u>Other</u> : staff	6 locations, West of Scotland Managed Clinical Network*: <u>MDt</u> : ENT-physician, oncologists; <u>Other</u> : staff	Support: level of technical support varied across the locations
Marshall et al. (2014)	<u>HC</u> : served as an educational tool; logistics on services not available at remote partner are discussed	<u>HC</u> : costs were an implementation barrier	Michael E. DeBakey Veterans Affairs Medical Center, Houston: <u>MDt</u> : oncologists, radiotherapist, surgeon, gastroenterologist; <u>MDd</u> : pathologists, radiologists, nuclear medicine physician; <u>Other</u> : medical administration	New Orleans (NOLA): <u>MDt</u> : oncologists, radiotherapist, pulmonologist; <u>MDd</u> : radiologist; <u>Other</u> : medical administration	HW: high-resolution VC equipment SW: Veterans Affairs linked IP-lines Room: 1 th screen for real-time VC interactions, 2 nd screen for sharing EMR data and case presentations Faults: audio quality slightly less than FtF
Alexanders-son et al. (2018)	<u>Patient</u> : better treatment plans for complex cases <u>HC</u> : gave shared culture and common understanding of cancer pathways in the networks; medical protocol and peer-review principles were advocated	<u>HC</u> : estimated cost of VC-MDTM was higher than MDTM, but there was no account taken for reduced time for travel	University hospital, Lund: [22 MDTMs, 13 VC] <u>MDt</u> : surgeons, oncologists; <u>MDd</u> : pathologists, radiologists; <u>Sd</u> : nurses	6 county hospitals: [28 MDTMs, 11 VC] <u>MDt</u> : surgeons, oncologists; <u>MDd</u> : pathologists, radiologists; <u>Sd</u> : nurses	<i>Not reported</i>

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
Van Huizen et al. (2019)	<u>Patient</u> : better treatment plans for complex cases due to discussion with 'fresh team' <u>HC</u> : kept viewpoints on medical protocols aligned in the network	<u>HC</u> : partner could not choose which patients to discuss due to the Dutch standard requiring the partner to discuss all patients with the centre; VC is an extra MDTM for the network	University Medical Center Groningen: <u>MDt</u> : ENT-, MF-surgeons, radiotherapist	Medical Centre Leeuwarden: <u>MDt</u> : ENT-, MF-surgeons, radiotherapist	HW: <u>centre</u> : 3 beamers; 5 camera inputs; 4 PCs of which 1 dedicated for PACS; <u>remote partner</u> : 1 PC showing data and imaging SW: 'Webex', optical fibre* bandwidth 2 Mbps Room: U-shaped table*
MDTM-Collaborate					
Hunter et al. (1999)	Web-based <u>Patient</u> : decreased unnecessary evacuations with cost savings <u>HC</u> : increased knowledge of clinical pathways for evacuation; stream-lined referral process with access to scarce facilities; served as an educational tool	<u>HC</u> : hindered logistics of fixed day and time 1) the day of the week (100%), or 2) the time of day (97%), or 3) low volume of interesting case presentations (100%)	Hawaii, Triple Army Medical Center: <u>MDt</u> : surgeon, oncologist, radiotherapist; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : psychologist, specialist nurse; <u>Other</u> : staff	Guam, Okinawa, Misawa, Korea, Camp Lejeune, Yokota, Yokosuka: <u>MDt</u> : surgeon; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : specialist nurse; <u>Other</u> : staff	HW: VC system, film digitizer, archive, telepathology system, web server for radiology images, workstation, conferencing telephone, digital projectors SW: net meeting desktop VC system
	ISDN <u>HC</u> : promoted collaboration; participants could see each other; fewer administrative tasks to get information displayed at the remote partner	<u>HC</u> : hindered logistics of fixed day and time 1) day of the week (95%), or 2) time of day (85%), or 3) low volume of interesting cases discussed (81%)	NC, David Grant Medical Center: <u>MDt</u> : surgeon, radiotherapist, oncologist; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : specialist nurse, social worker, technician; <u>Other</u> : staff	McClellan Air force base, Lemoore Naval: <u>MDt</u> : surgeon; <u>MDd</u> : radiologist; <u>Sd</u> : specialist nurse; <u>Other</u> : staff	HW: microscope, film digitizer, web server, PCs, conferencing telephone; camera, microphones SW: ISDN, bandwidth 384 Kbps, bridge support, PictureTel concord base codec; DICOM Faults: when network congestion telephone conferencing is used
Olver et al. (2000)	<u>Patient</u> : satisfied with reduced time away from home; less travel for patients <u>HC</u> : better understanding treatment possibilities; better treatment planning; isolated MDs felt better supported; tertiary centre reported better communication with partners; less travel for MDs; enhanced peer review; served as an educational tool	<u>Patient</u> : no physical examination of patient; less confidentiality (privacy) <u>HC</u> : not knowing each other or not knowing abilities of MDs at each site; increased workload of MDs; no reimbursement of VC	Adelaide Royal: <u>MDt</u> : oncologists, radiotherapist, palliative care clinicians; <u>Sd</u> : nurses; <u>Other</u> : staff	Royal Darwin Hospital: <u>MDt</u> : physicians, surgeons	HW: <u>centre</u> : camera; cameras mounted above light box; microscope for radiology and pathology; <u>remote partner</u> : portable VC unit Room: <u>centre</u> : 30-seat theatre Faults: image quality Support: logistics of displaying patient data

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
Davison et al. (2004)	<u>Patient</u> : reduced waiting time from diagnosis to treatment; increased clinical trial accrual <u>HC</u> : format made case presentations more concise and complete; increased availability of thoracic surgeon opinion on recent guidelines; three weeks of surgeon travel time saved	<u>HC</u> : upload digital CT images had to be planned and conducted before the meeting by centre and partner	Southend District Hospital: <u>MDt</u> : chest medicine physician, oncologist, <u>MDd</u> : radiologist; <u>Sd</u> : specialist nurse, technician	London Chest Hospital: <u>MDt</u> : thoracic surgeon; <u>MDd</u> : radiologist	<u>HW</u> : Tandberg VC Vision 800; <u>centre</u> : Radworks CT viewing station; <u>partner</u> : Sony CCD camera; DXC950 above light-box <u>SW</u> : 3 ISDN-lines, bandwidth 384 Kbps Support: technician was necessary to adjust camera, sound and radiographs (enabling medical staff to concentrate on clinical issues)
Kunkler et al. (2006)	<u>HC</u> : increased size and composition of the group with less experienced, younger staff in VC vs FtF; less travel for specialists	<u>HC</u> : during VC there is less knowledge available from experienced MDs, possibly due to logistic changes to the MDTM and difference in attendance	Edinburgh Breast Unit: <u>MDt</u> : surgeons, oncologist; <u>MDd</u> : radiologists; <u>Sd</u> : specialist nurses; <u>Other</u> : staff	Dumfries and Galloway Royal Infirmary: <u>MDt</u> : surgeons; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : specialist nurses	<u>HW</u> : Tandberg 2500 VC codec, twin digital projectors, networked PC, microscope and X-ray viewing system <u>SW</u> : ISDN-lines, NHS IP networks Room: U-form tables in room;
Kunkler et al. (2007)	<u>Patient</u> : VC and FtF have similar clinical effectiveness in quality of decision making <u>HC</u> : more core staff involved in the oncology centre VC vs FtF; less travel for specialists; better guideline compliance	<u>HC</u> : slightly fewer cases by VC due to technical problems	Edinburgh Breast Unit: <u>MDt</u> : surgeons, oncologists	Queen Margaret Hospital, Dunfermline / Fife: <u>MDt</u> : surgeons; <u>MDd</u> : pathologist, radiologist; <u>Sd</u> : specialist nurses	Faults: 5x no VC due to technical difficulties Support: improved access to required physical resources for VC vs FtF, but varied across locations
Stevens et al. (2012)	<u>Patient</u> : VC helped to decrease health disparities between urban and rural populations (improved access)	<u>Patient</u> : median time from diagnose to start treatment was longer (not significant)	Auckland District Health Board, VC-MDTM: <u>MDt</u> : surgeons, oncologists	Counties Manukau District Health Board, VC-MDTM: <u>MDt</u> : respiratory physicians; <u>MDd</u> : radiologist	<i>Not reported</i>
Murad et al. (2014)	<u>Patient</u> : impact on outcome through coordinated care <u>HC</u> : refinement of treatment through discussion; specialists at both sites have developed closer professional ties and aligned common practices; guidelines better followed for chemotherapy before and after surgery; served as an educational tool	<u>HC</u> : workload for oncological surgery increased threefold	NORI Hospital, Islamabad: <u>MDt</u> : oncologist.	Holy Family Hospital, Rawalpindi: <u>MDt</u> : surgeons; <u>MDd</u> : radiologists and pathologists	<u>HW</u> : Polycom VSX 7000 VTC camera, 42-inch liquid crystal display monitor <u>SW</u> : VC link using DSL connectivity
Novoa et al. (2016)	<u>Patient</u> : less travel for patients; increased frequency of thoracic surgery for new patients	<u>HC</u> : too many patients to discuss during VC, but not all outpatients for thoracic surgery should be discussed in VC	Healthcare Complex of the University of León*: <u>MDt</u> : thoracic surgeons	Thoracic Surgery of University Hospital, Salamanca*: <u>MDt</u> : pulmonologists, oncologists, radiotherapists	<u>HW</u> : computer with microphone and webcam <u>SW</u> : corporate application to access each other's' computer desktop

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
	HC: reduction in time for MD to see patients; reduction in duplicate tests; faster and more accurate diagnostic / treatment plans		Healthcare Complex of the University of León*: MDt: thoracic surgeons, radiotherapists	Hospital Nuestra Señora de Sonsoles de Ávila*: MDt: pulmonologists, oncologists	

For peer review only

Supplement 7: Terms regarding healthcare professionals

Overview of the terms for healthcare professionals found in the different studies and how they were grouped by the authors in Supplement 6 of this review.

Legend people mentioned present at VC MDTM

* The terms ENT-physician and ENT-surgeon are seen as equivalents because, for ENT, the disciplines are the same. In comparison, neurosurgeons and neurologists have different disciplines.
Abbreviations: ENT = Ear -Nose -Throat; MF = Maxillofacial; HPB = Hepatobiliary; VC = Videoconferencing; MDTM = Multidisciplinary Team Meeting.

<i>Code</i>	<i>Term used in original paper</i>	<i>Equivalent group term (Suppl. 6)</i>
Medical Doctor therapeutic (MDt)		
MDt	general surgeon	surgeon
MDt	plastic surgeon	surgeon
MDt	thoracic surgeon	surgeon
MDt	breast surgeon	surgeon
MDt	thoracic surgeon	surgeon
MDt	transplantation surgeon	surgeon
MDt	surgical oncologist +/- HPB	surgeon
MDt	ENT-surgeon	*ENT-surgeon
MDt	MF-surgeon	MF-surgeon
MDt	medical oncologist	oncologist
MDt	clinical oncologist	oncologist
MDt	gastroenterologist	gastroenterologist
MDt	hepatologist	hepatologist
MDt	treating physician	physician
MDt	general physician	physician
MDt	ENT-clinician	*ENT-physician
MDt	radiation oncologist	radiotherapist
MDt	pulmonologist	pulmonologist
MDt	respiratory physician	pulmonologist
MDt	internist	internist
MDt	Palliative Care (PC) clinician	PC physician
MDt	consultant chest medicine	thoracic physician
MDt	oncologic rehabilitation physician	rehabilitation physician
Medical Doctor diagnostic (MDd)		
MDd	radiologist	radiologist
MDd	diagnostic radiologist	radiologist
MDd	interventional radiologist	radiologist
MDd	pathologist	pathologist
MDd	nuclear medicine physician	nuclear medicine physician
MDd	medical physicist (supporting Nuclear Medicine)	medical physicist
Supportive Discipline (Sd)		
Sd	Macmillan cancer nurses oncology	specialist nurse
Sd	clinical nurse specialists in breast and colorectal cancer	specialist nurse
Sd	oncology nurse	specialist nurse
Sd	chemotherapy specialist nurses	specialist nurse
Sd	breast care nurses	specialist nurse
Sd	surgical nurse	specialist nurse
Sd	lung cancer clinical nurse specialist	specialist nurse
Sd	palliative care nurse	specialist nurse
Sd	nurse	nurse

<i>Code</i>	<i>Term used in original paper</i>	<i>Equivalent group term (Suppl. 6)</i>
Sd	extended practitioners (nurse practitioner / physician assistant)	specialist nurse
Sd	clinical trial nurses	research nurse
Sd	psychologist	psychologist
Sd	mammography technologist	technologist
Sd	oncology art therapist	art therapist
Sd	radiographer	radiographer
Sd	respiratory therapist	respiratory therapist
Sd	dietician	dietician
Sd	speech & language therapist	speech & language therapist
Sd	junior medical staff	medical staff
Sd	staff physician	medical staff
Sd	social worker	social worker
Sd	medical dosimetrist	medical dosimetrist
Sd	genetic counsellor	genetic counsellor
Sd	nurse navigator	case manager
Sd	case manager	case manager
Other		
Other	research staff	research staff
Other	allied health staff	staff
Other	audit staff	staff
Other	other MDTM participants	staff
Other	project director	staff
Other	systems network manager	staff
Other	systems manager	staff
Other	dedicated coordinator	staff
Other	meeting coordinator	staff
Other	medical secretaries	medical administration
Other	administration	medical administration
Other	meeting coordinator	medical administration
Other	cancer registrar	medical administration
Other	cancer network coordinator	medical administration
Other	cancer centre personnel	medical administration
Other	technician	technician
Other	mammography technologist	technician
Other	trainees	students
Other	students	students

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Title, page 1.
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Abstract, page 3.
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Introduction, page 4.
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Introduction, page 4.
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	Method, page 5 and supplement 1.
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Method, page 5.
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Method, page 5.
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Method, page 5 and supplement 2.
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Method, page 5.
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Method, page 5 and 6.
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Method, page 6.
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not applicable for scoping reviews.

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Method, page 6.
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Results, page 6 and Figure 1 – PRISMA-Scoping-Review flow diagram.
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Results, page 6 and supplement 4.
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	See item 12, not applicable.
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Results, page 7 - 10.
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Results, page 7-10. Table 1, 2, 3 and 4 with supplement 5.
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Discussion, page 10.
Limitations	20	Discuss the limitations of the scoping review process.	Discussion, page 11.
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Conclusion, page 13.
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	No funding

JB1 = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med*. 2018;169:467–473. doi: 10.7326/M18-0850.